DOCUMENT RESUME

ED 339 367 IR 015 330

TITLE	Information Technology for Training and Education (ITTE): Conference Keynote Addresses (Brisbane, Queensland, Australia, February 4-8, 1991).
INSTITUTION	Queensland Univ., Brisbane (Australia).
PUB DATE	91
NOTE	129p.; For the Conference Proceedings (Presented Technical Papers), see IR 015 329.
PUB TYPE	Collected Works - Conference Proceedings (021)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	Assistive Devices (for Disabled); *Computer Assisted Instruction; Computer Literacy; Computer Uses in Education; Distance Education; *Flight Training; Industrial Training; *Information Technology; *Instructional Systems; Interactive Video; *Job Training; Multimedia Instruction; Open Education; Postsecondary Education; Technical Education; Technological Literacy; Vocational Education

ABSTRACT

This volume presents the text of nine keynote addresses and an abstract of one other address presented at ITTE'91, an international forum and conference on Information Technology for Training and Education (ITTE). Each address is preceded by biographical information on the speaker and followed by a brief critique by a professional in information technology, instructional design, training, or education. The collection contains the following papers: (1) "An Antipodean View of Technology Based Training" (Nick Rushby, United Kingdom; critique by Brian Carss); (2) "Information Training Technology: The North American Perspective" (Thomas C. Reeves, United States; critique by Alan F. Holzl); (3) "Technology: A New Disability?" (Dennis Kviz, United States; critique by Michael Macklin); (4) "The Horse or the Cart?" (Apple Computer Representative; abstract only); (5) "Information Technologies and Training Issues in Qantas" (David Cormack, Australia; critique by Margaret Berenyi); (6) "An Open Learning Approach in the Industry Training Context" (John Sayer and Mike Donaghue, Australia; critique by Jeni Neary); (7) "IT Awareness--From the Board Level to the Coalface" (Neil Divett and Peter Lennon; critique by Ken Lyons and Pramod Sharma); (8) "Technology and Tertiary Education: Paradigm Shift or Technophobia?" (Rod Sims, Australia; critique by Michael Crock); (9) "Restructuring Vocational Training and Education for Information Technologies" (Tony Whittingham, Australia; critique by Helen Parker); and (10) "Tertiary Training in the Information Technology Age" (Craig Sherrin, Australia; critique by Steve Murray). (DB)

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Information Technology for Training and Education

Perspectives on Information Technology, Training and Education.

ITTE'91 Keynote Addresses

ITTE '91

4-8 February 1991

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INFORMATION TECHNOLOGY FOR TRAINING AND EDUCATION

ITTE'91

4th-8th February, 1991

KEYNOTE ADDRESSES

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Nick Rushby
Editor
Interactive Learning
International

Thomas Reeves
Chair
International Committee
Association for the Development
of Computer-based Instructional Systems

Dennis Kviz
Director
Compute Able Network

David Cormack
Manager
Operations Training Services
QANTAS

John Sayer
Associate Director
Queensland Distance Education College

Mike Donaghue
Training Superintendent
Callide B Power Station Queensland

Neil Divett
The Surveyor General
Department of Lands

Rod Sims
Executive
Australian Society for Computers
in Learning in Tertiary Education

Tony Whittingham
Chief
Computing and Information
Industries Training Division
TAFE NSW

Craig Sherrin
Manager
Vocational Education and
Training Technologies Centre
Queensland

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FOREWORD

ITTE '91 is an international forum and conference hosted by the Computer Assisted Learning (CAL) Unit and Continuing Professional Education of The University of Queensland from 4th to 8th February, 1991. If focuses attention on the contribution that information technology can make to training, retraining and education in the 1990's. In particular, the forum will concentrate on the following:

- Information technology and specialist training
- Technical training in post secondary situations
- Perspectives on large scale implementations of information technology for training and education
- Information technology and industrial training
- Information technology and the future.

This publication is the collection of Keynote Addresses that specifically address these issues and will set the scene at the conference. We have arranged this publication prior to the conference so that you can participate in the forum. All other papers presented at the conference are contained in a separate publication 'ITTE'91 Conference Proceedings'.

Critiques for each of the keynote addresses were invited from prominent professionals in the fields of information technology, instructional design, training and education. They were prepared prior to the conference as a response to each paper. However, the format of each critique was left to the individual. Therefore, critiques range from brief reviews, to traditional critical analysis, and to complete alternative position papers. Where appropriate the critiques are to be delivered immediately after the papers are presented and before taking questions from the floor.

Forewords often set up a framework into which the published papers fall, and this sometimes makes for easier reading. However it is not easy to put a framework over such a diversity of perspectives as provided by the Keynote Speakers at this conference. Each paper provides a distinct view of some apsect of information technology and either training and/or education. These views range from using information technology to simulate dangerous conditions encountered while learning how to operate a power station, to using information technologies to train large numbers of staff in a variety of situations, to using information technology to create awareness about itself so that a large organisation can move to policy development and large scale adoption of the technology.

We would like to express our thanks to Queensland Distance Education College (QDEC) for sponsoring this publication and to our other sponsors, listed below, for their help and assistance:

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INTERNATIONAL DAY

KEYNOTE ADDRESS

ONE

Nick Rushby
Editor
Interactive Learning International

Nick has been involved with the use of computers in education and training for over twenty years with experiences as a project coordinator with the UK National Development Program in Computer Assisted Learning, the Director of CEDAR, the UK national information service on the use of computers in education and training, and CITAR, a unit providing workshops and consultancy on the use of new technologies in training, and as a consultant at the London Centre for Staff Development in Higher Education where he was responsible for new technologies in training. He joined Sundridge Park Management Centre in July 1987, to set up Sundridge Park Training Technologies.

Nick Rushby has a wife, two daughters and a mistress.
The route by which he arrived in training technologies is tortuous (as it is for most training technologists) and is, perhaps, of some passing interest. In his early teens he built and flew model aeroplanes. He was not a skilled pilot (or perhaps there were serious flaws in the construction and repeated repairs). Despairing of the ecological impact of some much waste of balsa wood his parents suggested model railway engineering as an alternative hobby. This lacked the excitement of the white heat of the latest technology and he turned instead to electronics, purchasing a transistor (one semiconductor - not a radio).

This was a career decision and some years later, at University in North Wales (chosen for its setting in the mountains) he read electronic engineering. The digital bits were all right but the mathematics needed for telecommunications were too strenuous. Thus he gravitated to computer science where he perceived a sort of logic.

Teaching about computing led to teaching with the aid of computing. The rest can be found in the authorised biography!

His wife and the two musical daughters take up a significant amount of his spare time: the rest he spends with his mistress. 'Zulu Mike' (she despite the masculine name) is a Rutan designed Long-EZ (pronounced Ee-Zee): the best fun you can have without taking your clothes off. An unconventional design (known to aviators) as a canard pusher) it will take two people and luggage for a romantic weekend, over 1300 nautical miles (the distance from Brisbane to Wellington NZ) at 155 mph on 35 gallons of fuel. This is rather better than most sports cars!

So as to keep his mistress in the style to which she is accustomed, he helps to run a small air training company which operates various single and twin engined aircraft from Biggin Hill (just to the South East of London).

He has two major ambitions: to be able to fly an aircraft without looking out of the window (an Instrument Rating) and to grow up to be a person.

AN ANTIPODEAN VIEW OF TECHNOLOGY BASED TRAINING

Nick Rushby
Sundridge Park Management Centre, London

Abstract

Recalling that, in the proper sense, antipodes are reciprocal, this contribution examines some of the issues which characterise technology based training in Europe. It will take the three dimensions of technology, pedagogy (or androgogy) and politics (with both large and small 'P') and argue that, while the technology presents few difficulties, we are less competent at androgogy, and have yet to master the politics. We are still unable to design courseware that makes effective use of the technology that is already available and are lamentably poor at managing innovation and change.

INTRODUCTION

To a European, the antipodes mean Australia and New Zealand. The dictionary (Concise Oxford English) defines an antipode as "a place diametrically opposite, especially a region opposite to our own". My office is almost astride the Greenwich meridian and the opposite point of the globe is somewhere in the Southern Ocean, to the south east of New Zealand. I suspect that there is little or no technology based training activity at that precise location. According to my calculations (and I am no great navigator!) the opposite point to Brisbane is somewhere in the Atlantic off the African coast, and I suspect that there is little or no technology based training activity at that location either!

However, if we can accept that each antipode is a reciprocal of the other and agree not to take the title too literally, I would like to give you my view of technology based training in Europe. That view is biassed, sometimes cynical and continually changing.

A structure which I have found to be helpful in understanding what is going on in other countries (and sometimes in my own) is to look at it on three dimensions: the technological, the pedagogical (or in this case, since we are talking about training, the androgogical), and the political.

Moreover, my presumption is that the hardware, software tools and, to a certain extent the courseware, of technology based training, transcends national boundaries. It is the politics that characterise the local view. My intention is to show that, in the UK, in Europe and, I suspect elsewhere in the world, the technology presents few difficulties, we are less competent at androgogy, and have yet to master the politics of innovation.

TECHNOLOGY

I do not propose to say much about the technology in technology based training (the bits that break if you drop them). The past few years have seen a dramatic growth in the availability of technologies emerging from the development phase. My chief executive adopts the criterion that a technology is ready for use in training when people stop holding conferences about it. I believe that is too conservative, but it does stop us all getting too euphoric!

After a hiatus in which computer based training and interactive video were well established ('well established' is, of course, a relative term) and the emerging technologies of compact disc, intelligent tutoring systems, integrated services digital networks (ISDN) and satellite broadcasting were still some way from practical reality, we have been inundated with new technology.

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Practical reality

Perhaps I should explain what I mean by practical reality.

1. The term "user friendly technology" is an oxymoron (1) but before we can use technology to support training (instead of obstructing training) there does have to be an acceptable level of facility in its use. It must be reliable and the benefits of using it must outweigh the time spent in learning how to switch it on and operate it.

2. There must be enough of it about in training environments so that using the technology does not require special provisions to be made in the places where training is delivered, and trainees do not have to be trained in its operation. This will often mean that the technology is developed and provided for other purposes, with training applications as a by-product. Costs fall with large scale production and as the technology becomes established. The use of video recorders in training is a good example: they were not developed primarily for training purposes and most trainees already know how to use them.

3. We must have some sensible ideas about the design of learning materials that use the technology. If we do not, then we cannot hope to make effective and appropriate use of the technology and **the users will find out sooner or later**. I shall return to this particular soap box in the next section.

As a result of access to the technology that has been acquired as part of a general move towards automation, continual improvements in price performance and, in some cases, the attainment of a critical mass, most of us in Europe cannot complain that we are deprived of technology in training. Much of the consultancy carried out by my group is to help clients find their way through that technology: to decide **whether** they want and need to use it - before they determine when and how.

ANDROGOGY

In an analogous way to the word pedagogy (which is derived from the Greek, pais paidos - boy + àgogos - to lead) to mean the study of how children learn, **Androgogy** (aner, andros - male) is the study of how adults learn. Those who design technology based training are coming to learn that there is a difference!

About ten years ago, Dijkstra attracted a great deal of criticism for stating that microcomputers have set back computing by a decade. What he meant is that personal computing has made it possible for many more people to have access to computers and to control the way in which they use them. This has made it possible for them - and many other people - to make the same mistakes that were being made ten years ago and for which solutions had already been found.

The same is true of computer based training.

Training design

The first CBT packages used the techniques of programmed learning, developed and polished during the 1960s for print based packages. Pioneers did not ask whether that technique was a good way of using the new medium. During the 1970s we progressed

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1 **oxymoron,** n. (rhet). Figure of speech with pointed conjunction of seeming contradictories. (Concise OED)

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beyond a single programmed learning-like instructional style, with simulation and modelling. Then, with the advent of microcomputers, the new wave of CBT developers rediscovered programmed learning (without rediscovering the wealth of research and the books which described how it could be done well) and we were submerged in a tide of boring, instructional packages that were only partly effective.

Over the past years we have seen a little improvement in the quality of CBT materials. The simulations are much better, but the tutorial packages still resemble the most impoverished examples of programmed learning from the early 1960s. Although there may be alternative branches to cope with learners who get the answer wrong, the idea that the package should incorporate different strategies to cope with learners who have different learning styles is honoured more in the breach than in the observance. Some packages - the exceptions rather than the rule - do give some initial test of learning style, but then have difficulty in following through their good intentions.

There is, of course, a problem: if we acknowledge a number of different preferred learning styles and want our package to be able to accommodate all of them, then we will either need several different versions of the material - or we must be very clever in the design.

However, we can take some comfort in the opinion expressed by a leading North American computer based training expert, that designers in the UK (and, I think, in other parts of Europe) are more imaginative and produce better materials than their counterparts in North America.

Authoring languages, systems and environments

This brings us to authoring systems where the number of available tools has increased dramatically over the past two years. Two or three years ago the choice was between general purpose programming languages on the one hand, and CBT authoring languages on the other. Now it is complicated by systems that offer object oriented programming, and authoring systems that offer very sophisticated production tools to simplify the development of learning packages.

In practice, all programming languages, whether designed specifically for technology based learning or to be general purpose, are a trade-off between their ease of use and the range of facilities they offer. If an authoring language only supports one learning strategy (if for example, it presumes a linear branching structure similar to that used in simple programmed learning) then it can provide a simple framework into which the trainer-author can fit the text, questions, expected responses and branches. If however, it offers a wide range of strategies, different ways of presenting and accepting information, and ways of handling complex branching, then it will require a larger repertoire of instructions and be correspondingly more difficult to learn and to use.

But that was two or three years ago. We are now starting to see the results of developments in authoring systems to incorporate some of concepts previously found in general purpose programming. There is a shift away from authoring **languages** which enable the author to specify a sequence of instructions that must then be encapsulated and run under a suitable operating system, towards authoring **systems** which offer a complete toolkit and environment for design, implementation and validations, and the ultimate delivery to the learner.

Authoring systems are now treating the plethora of peripheral presentation devices (such as interactive video players, CD-ROM drives and the like) in an integrated way, rather than as a hotchpotch of hardware hung onto the computer at various times. The consistency of approach simplifies the author's task and makes it easier to modify materials when switching from one technology to another.

The impact of intelligent tutoring systems and, of equal significance, intelligent authoring systems, is only just starting to be felt. A funding programme under the UK Training Agency in the late 1980s supported the development of several packages based on artificial intelligence tools and techniques, some of which are now on the market. The European DELTA Programme (described in more detail below) is also active with large projects in this area.

Computer managed training

The computer managed learning or training systems developed during the last decade have also been essentially static. The course design has been encapsulated in the system in the form of an algorithm which determines how the learner should be assessed on each module, and the progression to the next module(s) in the defined sequence. Although some systems attempted to advise rather than to prescribe, they all assumed that learners were aiming for the same fixed goal at the end of the course. The ability of the systems to adapt their instructional strategy to the user's preferred learning strategy and goals was limited.

The aim of the Learning Credit Card under development at Sundridge Park Management Centre, is that the learning system should continually adapt to the evolving needs and aspirations of the learner and his or her organisation, by enabling the learner and the manager to review, on demand or at regular intervals, what has been achieved in terms of knowledge, skills or competencies (perhaps as a result of the course; perhaps as a result of other experiences) and what the new goals, seen in the light of the changing environment and the changing learner, should be. This may point the way for the new generation of computer managed training systems.

POLITICS

Funding programmes

UK Training Agency - Learning Technology Unit

The DELTA Programme is one of the initiatives of the Commission of the European Communities and is a major force for Developing European Learning through Technological Advance.

The task of developing European learning through advances in technology is substantial. It is not something that can be achieved simply by throwing money or at the problem, but requires a well developed strategy and careful management. DELTA is fortunately able to look at, and learn from, the wide range of earlier failed projects and programme that adorn the European landscape. It is important to realise that, when talking about education, the DELTA programme also encompasses training.

There are two phases. The aims of the first, exploratory phase was to build on existing developments, with willing collaboration by the participants to develop a basic infrastructure at a European level, to demonstrate prototype results and to encourage a consensus for future detailed technical results. The main phase is starting now and will run to the year 2000 and will demonstrate that the developments can be used to:

- prepare industry for the emerging and common market in educational tools and services;
- prepare a basis for the external promotion of these services;
- enable effective learning to take place;
- increase the cost-effectiveness of learning;
- stimulate private investment in technology based learning;
- overcome regional difficulties;
- solve sector problems and special needs on a European level.

DELTA intends to achieve these aims through a series of five 'action lines'.

The main objective of the first action line is to optimise the use of Community resources in developing learning technology. This involves the development of a Learning System Reference Model, establishing a European Learning Technologies Association, and encouraging the dissemination and exchange of information both within and beyond the DELTA programme. The second action line concentrates on the elements that form an open learning environment - the learner environment, support systems, and the authoring and production facilities. A central concept here is the Portable Educational Tool Environment (known familiarly as PETE). Action line III aims "to take full and early advantage of advances in telecommunications, of terrestrial networks and satellites, to support open learning systems. The fourth action line rejoices in the name of 'interoperability'. Its task is as difficult as the title is opaque: to address the standardisation and conventions issues within the DELTA framework. Finally, Action Line V is looking at promoting conditions that are favourable to the introduction of learning through technology in terms of the social, education, fiscal and regulatory environments in the Community. The 30 projects that have been funded in the current, preparatory phase of the Programme contribute to these action lines and will form the basis for future developments. Partly as an innovation strategy and partly to stretch the available funds, the projects only receive a proportion of the funding needed. The requirement to find a similar amount from their own resources or from other sources helps to eliminate weaker proposals and to concentrate the minds of the project groups. Having invested their own money in the expectation of success, experience shows that they are more likely to achieve their objectives.

The activity in DELTA is pre-competitive and incremental: in other words the projects are at a stage where the participants can collaborate without worrying too much about how they may compete in the marketplace at some later date, and they build upon work that has already taken place or is in progress under other European Commission funding programmes. There is a strong emphasis on collaboration - between industry and academia, between different companies and between different countries. It seems probable that significant resources are being consumed to fund the collaborative aspects, for example to pay for travel and communications, but the hope and expectation is that this investment will be justified by more successful innovation, dissemination and esprit de corps.

It is perhaps inevitable that the projects are not spread evenly through the member states of the Community. Some countries such as the UK, the Netherlands, Germany and France have considerable experience of, and expertise in, technology based learning and, in consequence have taken the lion's share of the programme. Other countries like Greece and Portugal are poorly represented.

UK Government initiatives

Support from the UK Government has come from three departments, the Department of Education and Science, the Department for Trade and Industry and the Department of Employment through its Training Agency (formerly known as the Manpower Services Commission). None of these is primarily interested in training except as a means to an end.

The Department of Education and Science has concentrated on primary and secondary education, providing funds for teacher education and for some development of interactive learning materials for use in schools. The impact on training has been limited, except that it has made the training population rather more aware of what might be done and thus raised their expectations.

The Department of Trade and Industry aims to promote UK industry and is therefore interested in developing a strong indigenous IT industry. To this end it has funded schemes to put UK personal computers in schools and more recently, to subsidise interactive video workstations in schools. In industry and higher education, it set up the Alvey Programme to promote the development of artificial intelligence tools and techniques. Some of these projects have researched and developed intelligent tutoring systems and have been of considerable benefit to technology based training.

A main focus of the Department of Employment throughout the 1980s has been to address the problems of structural unemployment and to reduce the numbers of those who are unemployed from the unacceptably high figures of ten years ago. We may take a cynical view of schemes for youth training (which move unemployed young people into training and therefore alter the statistics) but some of the supporting initiatives such as Open Tech have provided the incentive for more use of technology based training. The Learning Technology Unit of the Training Agency has funded a large number of projects to research and develop technology based training, and is perhaps the single most influential and effective body in this area.

There have been similar government sponsored programmes in other European countries, supported by commercial activities from bodies such as IRI in Italy whose agencies IFAP (for management development) and ANCIFAP (for supervisory and technical training) are starting to make a significant impact.

Training and Development Lead Body

Two years ago, the UK Training Agency embarked on a programme to develop sets of standards for various employments (for example, management, hotel and catering). These are linked to a scheme of National Vocational Qualifications. The aims are to identify the 'competencies' required by those working at different levels in that field, to help determine personal development needs of individuals and to standardise qualifications. One of those sets of standards is targetted at human resource development professionals and the lead body responsible for overseeing the work has just produced the first published version. It is too soon to tell what impact these standards may have beyond that of accreditation. There is some mention of the skills and knowledge required for technology based training, but it is likely that further standards will be produced to deal specifically with this area, and integrated with those that already exist.

Manpower

Experience has shown that, despite the growing sophistication of authoring systems, trainers need to acquire a range of additional skills in order to be able to design and produce effective and reliable technology based training materials. Most high quality packages, whether computer or interactive video based, are the result of a team effort, and many training organisations are starting to build teams to develop their own indigenous training materials.

Unfortunately, there is a growing shortage of people with the blend of skills needed to contribute to such teams. The shortage is leading to increased production costs and rising salaries: an experienced interactive video designer can now command a salary of over £20,000 Sterling. Part of the difficulty is that, while all of us in the training business grew up with, and learnt from, media like books, the overhead projector and video, very few trainers have ever experienced computer based or interactive video materials **as learners**. Most of us had to start from the very beginning with the new technologies.

It seems likely that things will get worse before they get better. A study in 1988 of recruitment and training needs in computer based training estimated that there were only between 520 and 800 professionals employed in the commercial courseware industry in the UK. If we include guesstimates for the numbers in the hardware sector and in noncommercial organisations such as local and central government, the armed forces and educational establishments, the total would be about double that figure. This number is perilously small to give us the strength in depth that UK Limited needs to retain its world leadership in this area.

The organisations consulted in the survey forecasted an annual growth of 10-15% over the next few years. This is very modest when contrasted with some market research carried out the National Computing Centre on behalf of a courseware production house. This suggested that the UK market will grow from £36m in 1985 to £230m by 1990 - an annual growth of over 40% which would require a further 3000 professional staff in the next three years! Statistics are dangerously unreliable. Using the lowest growth figures, only 500 more staff will be needed - but the history of technological growth is littered with underestimates and 40% per year may well be too low! Remember these figures are for the UK alone. The NCC survey predicted that the value of the European market for 1990 would be £1000m. Extrapolation gives 20,000 professional staff.

Although there are various general educational technology courses which now include TBT and a number of specialist short courses, the total output still falls far short of what will be required. Adequate manpower is a problem now and will remain a problem for some time to come.

The need for an association

After some years of ardent advocacy on behalf of resource based training, I was persuaded by my closest friend - and by straightforward observation - that people prefer to learn in company with other people. Companionship is important. Training technologists such as we, need the companionship of like minded people - to share ideas and act as sounding boards, to temper our foolish ideas and support those that have merit, and so that we know we are not alone.

There are many small groupings in the UK and Europe. Some of these are well established while others are quite informal. There is also a growing number of conferences and exhibitions, and of journals and magazines giving some coverage of training technology.

Technology based training is an interdisciplinary area and always runs the risk of falling into the cracks between information technology, training and personnel management. Thus, some organisations, such as the British Computer Society and the Institute of Personnel Management, who might be expected to include technology based training in their range of activities, tend to overlook it. This lack of professional focus is reflected in the wide range of possible forums for the training technologist.

As its name implies, The National Interactive Video Centre started life as a coordinating centre for IV in the UK. The Centre set up a number of small professional groups concerned with various aspects of IV. It soon realised that the boundaries between IV, CBT and artificial intelligence are fuzzy and largely irrelevant and then supported a second tier of groups such as AIIVS (Artificial Intelligence and Interactive Video Systems) with very specialised interests. The CBT Forum is a small group of major players representing IT manufacturers, and large users of CBT, together with some independent consultants. It has taken some important initiatives in the areas of standards for CBT and, in collaboration with the Institute for Training and Development, for accrediting the training of computer based trainers. However, in recent months, it has assumed a lower profile and has been overtaken by TACT, The Association for CBT. TACT is probably the fastest growing and the most active association serving TBT in the UK at the present time.

The Association for Educational and Training Technology (AETT) used to cover the entire spectrum of the technology of learning and technology in learning but in recent years has gone into decline with a dwindling membership and loss of direction. Other initiatives such as the Alvey Programme and DELTA are also leading to the formation of specialist groups, some of which are open to individuals and organisations from outside the programmes.

The overall result is a plethora of groups which fail to inter-communicate. In fact, many of them seem unaware that the others exist. As practitioners we cannot find the time to be active members of them all - even if we could afford the annual subscriptions. Yet chosing between them is difficult and often arbitrary.

There is a similar profusion of conferences and exhibitions. Here the problem is more pressing. The training technologist finds it impossible to attend more than a few of them, but the demands on the time of the speakers and exhibitors are even greater. They too, have to choose where they will speak or exhibit their wares and we are finding that their resources are being increasingly diluted.

The life of a professional conference speaker is attractive for a while, but the realisation soon dawns that too many conferences does not allow sufficient time to do any real work: next year there will be nothing new to say! It is, of course, quite possible to become a professional conference speaker. Each presentation increases your reputation a little more and makes it more likely that you will be invited to speak elsewhere. The real breakthrough comes when you are invited to speak in another country, for then you are assumed to have an international perspective and thus establish an international reputation which is likely to endure.

One of the key projects within the DELTA programme is concerned with the dissemination of information and with the formation of the European Learning Technology Association (ELTA). This seems to me to be the focus offering the greatest hope for a strong coordinating body to represent the interests of training technologists in Europe - and possibly further afield. Interactive Learning International is actively supporting and promoting that Association.

The technology based training business

There is a period debate as to whether there the interactive training industry exists. Up to now, the debate has centred on a definition of interactive training: it may now be more appropriate to consider its continued existence, for business is not good. The companies operating in this arena are financially uncertain, and their principals talk about 'consolidation' as a euphemism for a training market in recession.

The UK Training Agency funding programmes have paradoxically created a lethal legacy. A number of small companies specialising in the design and production of computer based training and interactive video based training, were established and grew throughout the last decade, sustained by grants from the Training Agency. Their products were introduced into the training departments of other companies through schemes that were also funded by the Training Agency. Now, as the public money starts to diminish, the customers, who are unused to paying the full price for such products are cutting back on their purchases, and the subsidies for developing new products are also being cut. The consequence is that several well known CBT and IV producers are in serious financial difficulties. Some are surviving by creative accounting while others are seeking marriages with cash-rich partners in the hope that the long term future will be better than tomorrow.

My own group is fortunate in this respect. Not only are we a part of the PA Consultancy Group (which is a major international player) and thus have the opportunity to integrate our work within the total consultancy offering worldwide, but we have been, from the outset, eclectic in our use of technology. Because we work with a wide range of technologies of training as well as technologies in training, we are able to concentrate on meeting training needs, rather than being led by a single product and trying to crowbar the need to a single solution.

Problems of marketing

Our experience in the UK and elsewhere in Europe is that there is a very long lead time in the introduction of technology based training. Potential users have no previous experience of training, or of being trained, with technology. They find it difficult to imagine how the new technologies can help them meet their training needs. The process of helping them to develop this imagination to the point where a significant number will decide to use technology based training on a pilot basis can take as long as 18 months: full acceptance comes even later.

Innovation

Fifteen years ago I joined the UK National Development Programme in Computer Assisted Learning as a project coordinator. That programme, which ran from 1973 to 1977, announced from the outset that it would close on 31st December 1977 and that there would be no continuation of the funding. All of its many projects were required, as part of their contracts, to investigate the ways in which their courseware could be transferred to, and used in, other organisations, and to investigate the ways in which they could secure their continuing operations after the funding ended. Having made a plan for survival - they were required to put it into action!

Some of the projects thought it was a bluff: they had but a short existence in 1978.

Richard Hooper, the Director of that Programme, used the metaphor of 'getting into the brickwork' so that the use of computer assisted learning could not easily be discarded. In many upland areas of Britain (and perhaps in Australia too) we have dry-stone walls. Walls are made from the pieces of stone that were cleared from the field. There is a considerable skill in making a dry-stone wall and it is much more difficult to select and place the irregular pieces of stone so that they lock together without cement or mortar to bond them. But once it is well made it will stand far longer than a wall of bricks and mortar. Building a dry stone wall is a good metaphor for the process of innovation that is needed to establish technology based training in an organisation.

It is exceedingly difficult and we are not very good at it. Our failure is the main reason why technology based training is not more widely used in Europe.

CONCLUSION

This is, of necessity, a very brief and personal view of technology based training in Europe. There is certainly a lot of it, even though it does not appear to be a very profitable business venture in the short to medium term. However, the technological foundations are firm and ever expanding. We are learning more about how to design materials so as to make effective use of that technology in training. As for the problems of innovation, I would like to quote one (anonymous) company as it decided to enter the marketplace: "We are likely to lose a lot of money by getting involved in technology based training: we will lose a great deal more if we do not!"

ACKNOWLEDGEMENTS

Over the past two years I have contributed a monthly column on Training and Technology to the journal 'Personnel Management'. This chronicles my personal view of technology based training in the UK and I have taken this opportunity to update and integrate some of that material in this paper.

I should thank my staff at Sundridge Park Training Technologies who all have considerable experience in creating innovative solution to training needs, are internationally recognised as experts in the field, and are generous in sharing their views about technology based training. Without those views, this paper would be the poorer. And, as always, my thanks to my continual friend and mentor.

RESPONSE

An Antipodean View of Technology Based Training

by

Nick Rushby

Response by

Brian Carss
Continuing Professional Education
The University of Queensland

Nick Rushby in his paper refers to three elements as being important for consideration, technology, pedagogy/androgyny and politics. He proceeds to devote much of his discussion to the issues in the last two elements after having somewhat summarily dismissed technology as 'presenting few difficulties'. While this may be the case now,m I believe that we are in our present uncertain state with respect to the last two elements as a direct result of the idiosyncratic approaches taken by the major manufacturers in the earlier development of software and hardware. Competition was and is the 'name of the game'; in all industry, but particularly in Information Technology. This unconstrained development has results in incompatible hardware, software and operating systems and massive frustration on the part of the users. Users tolerated these problems for a while until a wide range of applications programs appeared which had wide appeal and to which they wanted to gain access. All to often these applications program had been developed for delivery on a specific manufacturer's platform leading to more frustration on the part of others who had incompatible hardware.

Fortunately the situation has changed as the hardware has changed putting more and more power at the fingertips of the user. The applications developers now routinely write different versions of their software for the major operating systems. Progress has been made in programming languages also to improve their portability. With respect to telecommunications the OSI movement already has agreement on a number of international standards and communications software using these international standards is available. Networks with multi-vendor workstations are now a reality. All of these factors have previously hindered developments in CBT by appearing to place insurmountable blocks in the path of development.

For the first time, I believe, we are in a position where we can seriously consider writing good instructional materials as we now have powerful enough tools to do the job. The only problem that I can see to hinder this is still the lack of compatible standards in graphics. Yet graphics are an essential element of good instructional materials. Some sense is beginning to emerge in the area of CBT authoring systems too. Although we have catalogued more than 200 CBT authoring systems and languages, many of these exist only on the machine of the developer. However, the early work on the PLATO system at the University of Illinois has had a considerable influence on products such as TenCore, Authorware and First Course of Action which I see as beginning to dominate the CBT scene in Australia. It is interesting but not surprising to note that these products demonstrate convergent evolution.

CML has had its own unique problems by being caught in the 'tug of war' between the trainers, who see it as an efficient accountability tool for their training, and the trainees who see it as a 'big brother' remorselessly peering over their shoulders to see what they are doing. The latter group advance the argument that they should be left alone to make their mistakes in private. They say they want to be the judges of when they have achieved mastery of the instructional materials. CML can do much more than just record students progress. It can be used as both a diagnostic and counselling tool and this seems to have been ignored. Some of the early work carried out under the National Development Program in CAL (NDPCAL) referred to by Rushby, used student

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responses to determine which paths through the instructional materials were opened. We could do well to revisit some of this early work when we are considering designing new systems.

The unrestricted collection of student statistics creates a problem of storage. A mere half hour of a student session can generate several megabytes of data. Clearly, this is beyond the reasonable storage capacity of a personal computer and should be transferred onto a mainframe. Such transfers demand a high speed transparent connection between the personal computer and the mainframe of the kind offered by the Digital Corporation with its PCSA applications package. Through it, student data are automatically downloaded and uploaded at the beginning and end of each student session.

It is with a degree of envy that I read of the U.K. Goverment's support of information technology education and training. It is frustrating at least to see how much use is made of information technology in education and commerce and yet the Australian government has shown only a passing interest in supporting an educational program in schools. At the tertiary education level, the push for information technology training has had to come from the individual institutions. There has not been any focussed governmental initiative despite all of the rhetoric about Australia having to become a 'clever' country. At least the Training Guarantee Act 1990 has been an attempt to 'jump start' training in industry and it, in turn, has already triggered an interest in CBT. The motivation for this increased interest does not appear to have anything to do with the quality of training that can be delivered by this medium, but rather it is to do with the economics of training. The use of CBT is an attempt to capitalise recurrent costs.

One thing that Australia does have in common with Europe and that is the lack of trained trainers. Until very recently, there was not one tertiary institution in Australia that offered an award program in Instructional Design and yet this has got to be seen as the single most important skill for any potential CBT trainer to have. Australian organisations have had to recruit instructional designers from North America or look to poach existing ones in this country from competitors. If the 1990's is going to be the decade in which CBT comes into its own as Nick Rushby suggests, then the critical shortage of experienced CBT designers has got to be addressed. One can hope that the European Learning Technology Association (ELTA) will take on this task as being one of high priority.

Richard Hooper as Director NDPCAL spoke fervently in the mid-1970's about the need for projects to 'get into the brickwork'. This is a phrase that has stayed with me since I visited the NDPCAL project and something that I have tried to implement in the establishment of the CAL Unit at The University of Queensland. I worked at making sure that this unit should become a part of the fabric of the institution. Subsequent events have reinforced the view that institutional commitment is vital for the long term survival of such developments.

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INTERNATIONAL DAY

KEYNOTE ADDRESS

TWO

Thomas Reeves
Chair
Association for the Development of Computer-based Instructional Systems (ADCIS)

Dr Thomas Reeves is an associate professor of Instructional Technology and a member of the Graduate Faculty in the College of Education at The University of Georgia located in Athens, Georgia, USA. Dr Reeves has been involved in the development and evaluation of instructional delivery systems since completing a Ph.D. in Instructional Technology at Syracuse University in 1979. He teaches program evaluation, instructional design, and research methodology courses to graduate students and offers workshops on evaluation and design of interactive video for a wide variety of clients. He also directs funded research and development projects for business, industrial, military, medical, and government clients.

Among the innovative projects to which Dr Reeves has contributed are the STARS interactive videodisc (IVD) for the University of Maryland, the 'Focus of LOCIS' IVD for The Library of Congress, the 'Critical Care in Nursing' IVD programs for DuPont, the 'Chronic Unstable Knee' IVD simulation for the National Library of Medicine, the 'Principle of the Alphabet Literacy System' literacy training IVD program for IBM, the Computer-Assistance for Science Teachers (CAST) IVD program for the National Science Foundation, and the 'Macintosh Fundamentals and Beyond' IVD course for Apple Computer, Inc. Dr Reeves has also planned and conducted evaluations of many interactive program including the Acute Combat Trauma Life Support program for the US Navy and sales/support training for Apple Computer Inc.

Dr Reeves is an active researcher and author, evidenced by more than 30 publications and 70 presentations at professional meetings. He serves on the editorial boards of the Journal of Educational Computing Research and Interact Journal. From 1986 to 1988, Dr Reeves was editor of the ADCIS News, a publication of the Association for the Development of Computer-Based Instructional Systems (ADCIS). He served as President of ADCIS in 1988-89 and he now chairs the ADCIS International Affairs Committee. He is also active in the Society for Applied Learning Technology, the Association for Educational Communications and Technology, and the American Educational Research Association. In October 1988, he co-chaired the first joint Soviet-American conference on 'Children, Education and Computers' held near Moscow, USSR. He has made additional international presentations in Bulgaria, Canada, Great Britain, Peru, Switzerland, Taiwan, and West Germany.

INFORMATION TRAINING TECHNOLOGY: THE NORTH AMERICAN PERSPECTIVE

Thomas C. Reeves, Ph.D.
The University of Georgia, USA

Introduction

Ever since the dawn of information training technology, enormous energies and resources have been spent in the search for the one training technology that would outperform all others. Over the years, radio, film, television, programmed instruction, computer-based training, interactive videodisc and other media have all competed for the title of "The Best Training Technology." It is my pleasure to announce that the search for the winner is over! However, this quest has ended not because an instructional panacea has been found, but because trainers in business and industrial contexts have at last accepted the realization that a rich mix of instructional technologies is required to effectively and efficiently train workers for the 21st Century.

Does this mean that all training technologies are equally effective? Of course not! The articulation among trainee characteristics, instructional objectives, context, and instructional media and methods is more important than ever because of a host of complexities that will plague training throughout the 1990's and into the next decade. What are these complexities? And what technology-based solutions to these problems are being developed by business and industrial trainers on the North American continent? Answering these questions is the focus of this paper.

The Complexities

The first complexity facing trainers in the 90's and beyond is that **knowledge, skills, and attitudes have shorter productive life spans than before** (Rose, 1989). For example, consider the knowledge, skills, and attitudes that must be learned by a computer salesperson. Much of the salesperson's ability to sell depends upon competitive product information and how the manufacturer positions the computer as a product vis á vis other products. In 1987, Apple Computer, Inc. positioned the Macintosh microcomputer as the computer "for the rest of us," emphasizing its ease of use compared to other systems. This theme was at the core of the training developed by Apple's Training Support Department that develops sales, marketing, and technical training for Apple employees and certified Apple sales representatives. Early in 1988, a new sales theme was introduced based on the idea of selling the Macintosh as the solution to specific problems faced by various vertical markets. Apple training courses and materials were revised to reflect this new approach. Since 1988, there have been other themes, all based on changes in the marketing positioning of the computer. For example, Apple, after introducing three new "inexpensive" versions of the Macintosh on October 15, 1990, is spending forty million dollars to promote the Macintosh as the microcomputer with the most aggressive pricing structure in the marketplace.

Each of these marketing approaches required significant changes in the knowledge, skills, and attitudes possessed by those authorized to sell Macintoshes. In 1987, Apple's primary training strategy was to bring all the sales personnel together for large sales and marketing meetings in Hawaii or other appealing locales. Today Apple still hosts sales meetings, but these are enhanced and extended by a mix of locally delivered training technologies including satellite downlinks, corporate television, and interactive learning systems.

Apple is not alone in the need to train and retrain its employees so that their knowledge, skills, and attitudes can keep up with rapidly changing internal and external factors. IBM recently acknowledged that the parochial knowledge of IBM products and allegiance to its corporate

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culture that were the hallmarks of IBM employees of the past will not be appropriate in the workplace of the year 2000. Instead, IBM realizes that its employees will need a complex mix of skills that will be constantly evolving. Indeed, as more and more North American businesses and industries confront ever-increasing global competition, they are discovering that the knowledge, skills, and attitudes of their employees need constant updating and on occasion, complete revisions. The role and responsibility of the education and training personnel within corporations have never been more important.

A second complexity is that **the workplace itself is becoming increasingly complex**, reflecting the globalization of markets, financing, manufacturing, and information as well as the need to introduce new products and services at a very rapid pace (Cetron, 1987). From the perspective of individual managers or workers, this increased complexity will largely result from team or project-based organization of their work, as opposed to a traditional hierarchical function-based organization. Increasingly, reward and recognition for achievement will be based upon team achievement as opposed to individual performance. Many companies such as Volvo in Europe and Sony in Japan have led the way in developing team-based work and reward systems. North American companies are struggling to catch up.

Although the advantages of project-based structures, e.g., increased productivity, shorter development times, and higher profit margins, clearly outweigh the disadvantages, there are problems in communications and internal operations that must be solved. Electronic tools for communications, management, and training are essential. The challenge for training personnel is helping workers and managers learn to use these new tools to the point of automaticity. The difficulty in this can be seen in a device as commonplace as the telephone. A few years ago, it was safe to say that virtually every worker understood how to use the telephone. Today, there are many workers who simply don't understand how to operate their multifunction phones to transfer a call or arrange a conference call.

A third complexity is a consequence of North American demographics that indicate that **the entry level personnel of tomorrow's workplace will have declining educational attainment and that their value systems will be different from the traditional work ethic of previous generations** (Wolman, 1990). Workers of the 1990's and beyond will be heterogeneous in culture, value systems, age, and skill level. For professional workers, the rising interest in self-development and career success will be matched by a declining interest in job security and company loyalty. For manufacturing and service workers, there will be more interest in the quality of life than in bringing home a paycheck.

As a result of the changing nature of the workforce, education and training must be designed to accommodate multiple languages, diverse attitudes toward work, individual learning styles, varying levels of literacy, and changing sources of motivation (Caine & Caine, 1990). In the past, it was sufficient for trainers to deliver instruction and the burden of its effectiveness fell upon workers and their managers. In the future, trainers will be accountable for improved performance, not just delivery of training. This demands real as opposed to "lip service" attention to evaluation!

A fourth complexity deals with the nature of what must be learned in the future. Businesses in the year 2000 will base their success and profits much more on service than on products, and more workers will be knowledge or information workers as opposed to manufacturing or labor (Albrecht & Zemke, 1985). **The content of tomorrow's training will emphasize problem solving, information processing, decision making, communications, and interpersonal skills** (Sculley, 1987). In the past, trainers concentrated on packaging training in such a way that it could be economically delivered to assembled groups of workers. Emphasis was placed on encapulization of information. The knowledge explosion occurring in virtually every field means that it is futile to attempt to package content information for each worker (Wurman, 1990). Instead, workers must be given the skills and opportunities to direct their own learning and continuously develop new skills. As noted above, knowledge per se will have a shorter and shorter lifespan. The real challenge will be teaching workers to access information and use it as needed.

A fifth complexity is the likelihood that **there will be significant shortages of first rate trainers.** Companies can no longer afford to take their most productive personnel and make them trainers. In increasingly competitive environments, businesses must keep their most productive workers on the front lines. Further, changes in the nature of what must be learned, e.g., skills versus knowledge, place limitations on the potential effectiveness of human trainers. First, it is becoming increasingly clear that experts in many different fields are unable to explain how they make decisions in such a way that they can teach others. Second, adult learners learn best from experience, real or simulated, and human trainers are not efficient providers of experiential learning.

A sixth complexity is that **training personnel today are confronted with an almost bewildering array of technological innovations that seem to be forthcoming at a faster and faster pace** (Tapper, 1990). Some of the innovations involve hardware, some software, and others are combinations of technologies. A partial list is represented in Figure 1.

- **artificial intelligence**
- **authoring systems**
- **cellular communications**
- **desktop video**
- **fiber optics**
- **HDTV**
- **hypermedia**
- **interactive multimedia**
- **networking**
- **optical storage devices**
- **satellite communications**
- **systems applications architecture (SAA)**
- **Unix**
- **virtual reality**
- **visualization software**
- **Windows**

Figure 1. Innovations in information training technologies for the early 1990's.

How can training development personnel keep up with technical advances in any one of these areas, much less all of them? Consider optical technologies. By this time, almost everyone is familiar with interactive videodisc and CD-ROM, but what about other optical delivery systems such as CD-I, DVI, CD-V, CD-WO, CD+G, LD-ROM, and CD-3? (See *The Compact Disc: A Handbook of Theory and Use* by Ken C. Pohlmann (1989) for a complete explication of these and other optical disc formats.) Business and industrial trainers searching for effective and efficient multimedia training technologies today are likely to find themselves drowning in "acronym soup" in a very short time. Advertisements and technical data sheets for these various optical discs can bewilder instructional designers with mind-boggling statistics about standards, storage capacity, error rates, data formats, audio specifications, and video capabilities. Attempting to keep up with the ever-increasing proliferation of optical formats adaptable for multimedia training will frustrate even the most dedicated technophile. How many training managers lay awake at night, fearing that the training delivery systems they have just purchased will be obsolete tomorrow?

These complexities and a host of others have created a business environment in which the established training approaches are no long viable. Figure 2 summarizes some of the characteristics of the old and new contexts for information training technology.

New		Old
Local, loyal markets	⇨	**Global, changing markets**
Stable content	⇨	**Rapidly changing content**
Function based organization	⇨	**Team/project based organization**
Well educated new hires	⇨	**Poorly educated new hires**
Value on loyalty and job security	⇨	**Value on self-development and career opportunities**
Training for specific job-related skills	⇨	**Training for generalizable problem solving**
Reliance on human trainers	⇨	**Scarcity of human trainers**
Standard training delivery system, i.e., lecturer	⇨	**Proliferation of training technologies**

Figure 2. Old and new contexts for information training technology.

The complexities of the evolving business and industrial contexts of the 90's and beyond present enormous challenges for trainers and educators, but it is far from overwhelming. Complexity can be defined as a phenomenon that exists between complete determinism and utter chaos. Overcoming the complexities described above starts when the complexities are recognized and acknowledged. An analogous situation can be found in the field of physics where the Newtonian laws of classical physics once seemed sufficient to explain the motions and interactions of all physical phenomena. Quantum physicists, however, have discovered new complexities at the sub-atomic level that defy Newton's laws. At first, it appeared that all was chaos at the nuclear level of analysis, but new theories have been developed after painstaking research. Much of this research has depended upon the development and use of new tools, primarily the computer as a device for building and refining complex theoretical models (Pagels, 1988; Prigogine & Stengers, 1984). It is clear that without powerful computers, many physicists and other scientists could no longer deal with the complexities involved in their fields. Similarly, in business and industry, trainers are realizing that the solutions to the complexities they face depend in a very real sense on the computer.

The Solutions

Given the complexities facing training personnel in North America as described above, it is clear that the solutions must be nothing short of revolutionary. It would be overly optimistic to claim that the revolution is well underway in North America today because, in truth, it has barely begun. Ronald Tapper (1990), President and CEO of Applied Learning, the largest commercial provider of technology-based training in the United States, said that his company estimates that less than 1% of the market for interactive training technology has been tapped. However, recent events in geopolitics such as the fall of the Berlin Wall and dismantling of the Iron Curtain should encourage us because once a revolution is begun, dramatic events can occur with startling speed. Therefore, the remainder of this paper is an attempt to describe some of the optimistic and dynamic signs of the training revolution still to come.

One of the essential thrusts of a training revolution should be **the integration of work and training via powerful workstations** (Perelman, 1990). In the future, very few workers will stop working and go to training. Instead, an increasing number of workers will be assisted in their work and learning by some form of performance support system (PSS), i.e., a computer-based system that provides on-the-job access to integrated information, advice, and learning opportunities (Puterbaugh, 1990). One example of a PSS is being used by employees of Prime Computer, a Fortune 500 company (Raybould, 1990). Prime found that its employees were being inundated with enough technical documentation each year to fill several bookshelves, and decided to place all technical information on CD-ROM. But the Prime PSS does more than just provide rapid access to technical data, it enables workers to develop knowledge when it is needed rather than in the context of prescheduled training courses (see Figure 3).

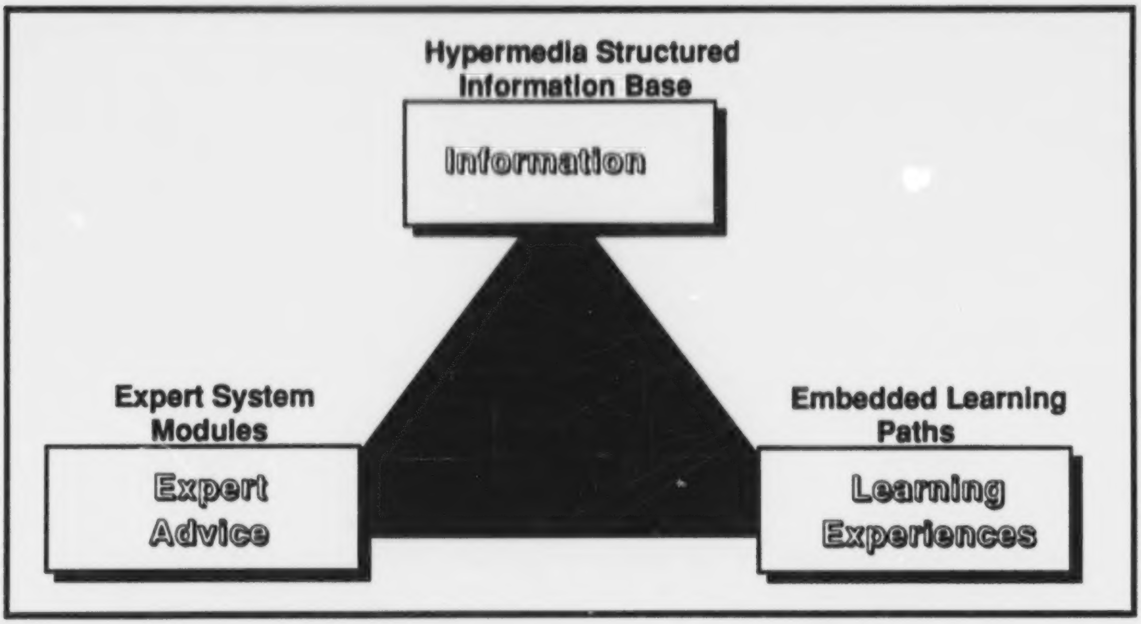

Figure 3. Three major components of the Prime PSS (Raybould, 1990).

There are three major components in the Prime PSS, an advisory system, an information base, and learning experiences. The advisory system provides intelligent job aids, the information base enables workers to search a rich textual and graphical database, and the learning experiences enable workers to participate in realistic simulations closely related to their work demands. The central interface of the Prime PSS is "programmed" with HyperCard, and it is also used to launch other software such as a CBT authoring language, an expert systems shell, and a graphical animation package. According to Raybould (1990), beta testing of the Prime PSS indicates that the savings resulting from lowering the costs of printing technical documentation alone are more than enough to pay for the delivery systems.

The Training Support Department of Apple Computer, Inc. is experimenting with another type of PSS, viz., "ID Library," developed for Apple by the author and other faculty and graduate students from The University of Georgia (Gustafson & Reeves, 1990). Apple's ID Library differs from the Prime PSS in that it integrates the advisory, information, and learning components with a powerful set of productivity software tools. Engineers have enjoyed the power of computer-aided design/computer-aided manufacturing (CAD/CAM) systems for a number of years in a wide variety of contexts, e.g., automobile production. ID Library represents a major step toward an analogous design system for professional instructional designers. The information base and decision aids in ID Library employ HyperCard, but the tools use a variety of commercial software packages such as Microsoft Excel and Claris MacProject II. Although version 1.0 of ID Library uses only text and graphics, future versions of ID Library are expected to integrate interactive video to provide instructional designers with more concrete models of development procedures and instructional options.

To meet Apple's needs for increased productivity and standardization of development processes, ID Library was created in the mold of classical systematic instructional development models (see Figure 4). Its goal is to provide guidance and structure in planning, designing, developing, evaluating, implementing and managing course development. ID Library has to accommodate course developers possessing a wide range of skills and levels of experience from novice to expert. ID Library guides and informs team members while providing a common vocabulary to facilitate communication, coordination, and management across all phases of the development process.

ID Library is seen as the initial prototype of a Macintosh based workstation for instructional designers. Future enhancements will result in an environment that makes all the tools and information necessary for performing all tasks related to the development process readily available to instructional designers. When networked, multiple designers can share information, drafts and final products and track the progress of projects with relative ease. A beta test of ID Library conducted in the summer of 1990 at several Fortune 500 companies (including American Airlines, Dow Chemical, Federal Express, Kodak, and McDonnell-Douglas) supported the viability of such a system in multiple training development contexts. The primary obstacle in the use of the system, however, was the reluctance of some personnel to learn how to use a wide variety of different software programs. Future Performance Support Systems should be standardized around a common set of applications so that this reluctance and the associated learning curve is reduced.

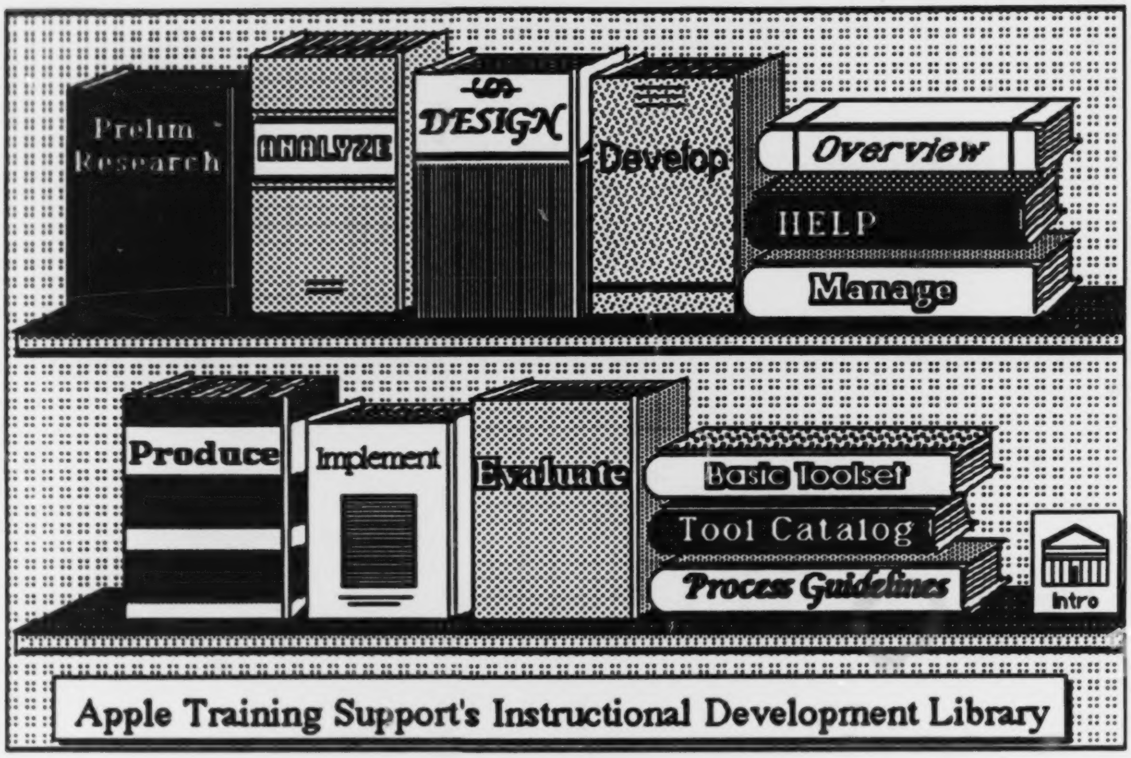
Prelim Research
ANALYZE
DESIGN
Develop
Overview
HELP
Manage
Produce
Implement
Evaluate
Basic Toolset
Tool Catalog
Process Guidelines
Intro
Apple Training Support's Instructional Development Library

Figure 4. Home screen for ID Library (Gustafson & Reeves, 1990).

The integration of work and learning is dependent upon the development of powerful multimedia workstations as the primary training and performance support system. Ultimately, training solutions to business problems should be blended with non-training solutions for all knowledge workers via the integration of embedded job aids and advisors, information databases, training simulations, and productivity tools. In the end, a virtually seamless interface will exist between job situations and training materials.

For those workers who will not use workstations as part of their normal work, **a particular instructional method, known either as interactive multimedia or hypermedia, offers a promising solution to the complex requirements for training today and in the years to come.** In one sense, multimedia can be regarded as essentially computer-based training enhanced with video, animated graphics, audio, and other special effects (Brand, 1987). On the other hand, multimedia can be viewed as a training philosophy that emphasizes the primacy of the learners' abilities and interests, and attempts to accommodate individual differences with the precise mix of media and interactions needed by individual learners. Simulations are probably the most powerful types of multimedia programs for teaching workers who do not already have workstations at their job sites (Haslam, 1990). Adult learning theory clearly indicates that education and training must be problem centered and immediately applicable if it is to have a chance to help adults learn. Simulations provide relevant, problem-centered experiential learning (Foshay, 1990). Henderson (1990) argues that interactive multimedia simulations can be developed to such an extent that they can approximate virtual realities.

Multimedia comes in many formats including interactive videodisc (IVD), compact disc-read only memory (CD-ROM), laser video-read only memory (LV-ROM), compact-disc interactive (CD-I), digital video interactive (DVI), and others. Some of these delivery modes exist only in the laboratory or at a few highly secretive beta sites. Nonetheless, industry leaders have released descriptions of the media options included in the various technologies. An analysis of this information reveals that all will have many of the same capabilities including: a) large text and data storage capability (up to 650,000 pages of text or 650 megabytes of data), b) large audio capacity (four to twenty hours depending on fidelity), and c) motion video (5,000 to 40,000 frames depending on resolution and screen size). The real question will be which technology has the value, strength, flexibility, simplicity, and attractiveness to capture the creativity and industriousness of professional trainers. The optical-based revolution in training seems even more possible given the success of CD audio discs in the home market.

The implementation of interactive multimedia for education and training in the future will be effective if and only if it meets all of the following criteria. First, it must be accessible, i.e., learners must able to engage in learning when and where it is most needed and/or convenient for them. Second, it must be modular, i.e., "chunked" into meaningful sections that address discrete skills so that learning can accomplished in meaningful time frames. Modularization also promotes a sense of progress and accomplishment on the part of learners. Third, interactive multimedia must be structured in such a way that learners can conveniently stop and start instruction according to their needs and desires. Fourth, it must engage a comprehensive range of the learners' senses, learning styles, and aptitudes so that they can learn in the ways most effective for them. For some learners, this may mean complete control over their own progress, rate, and path through a program. Other learners may require more guidance or structure as provided by online mentors. Fifth, ideally it will be both intrinsically and extrinsically motivating. Intrinsically, it must grab the learners' attention and hold it. Extrinsically, it will be linked to clearly defined external reward structures.

Interactive multimedia is not a panacea that guarantees learning. However, there is ample evidence that it can be a highly effective education and training system across a wide range of instructional contexts (Reeves, 1988). The secret of its success lies in its ability to actualize the dimensions of instruction that research in cognitive science and adult learning have identified as effective and efficient instructional strategies.

Another positive sign of the revolution in training is **the increased interest in measurement expertise and tools upon which to base learner profiles and employee development plans and a stronger desire to evaluate the effectiveness and impact of training.** Testing and evaluation were once regarded as relatively simple matters, but research into the nature of human intelligence and the discovery of a number of important individual differences in learning styles, personality variables, and motivation have alerted trainers to the difficulty of these procedures. As trainers began to realize the limits of paper-and-pencil tests as measures of complex skills, they fell back onto the safe position of "evaluating" training simply on the basis of whether trainees liked it or not. The post-training questionnaire or "smilometer" became ubiquitous as an evaluation instrument.

Today, it is realized that at least four levels of evaluation must be included in a comprehensive evaluation of training: trainee reactions, knowledge and skill improvements, application to the job, and business results. Trainee reactions which can be assessed through questionnaires, interview, observations, and self-reports can provide valuable information for improving a course. Knowledge and skills can be assessed with traditional tests, embedded tests, performance exercises, in-basket exercises, and simulations. Given the difficulty of measuring changes in behaviors and attitudes, it is often necessary to measure each aspect of the outcomes of a training program several different ways in an effort to "triangulate" the desired outcome. Application of new knowledge, skills, and attitudes "on the job" are even more difficult to evaluate, but observations, supervisory reports, peer assessments, diaries, and other procedures can be used to estimate the degree to which training transfers to the workplace. The ultimate impact of training, i.e., its effect on business in terms of profits, expanded markets, safety, or other factors is the most difficult aspect of evaluation of all because of the many conflicting explanations for any given business result. Nevertheless, if training is to retain its value within an organization, trainers must attempt to assess the ultimate impact of their efforts.

Another promising, albeit controversial, development shaping the coming training revolution is **the development of systems for automating the instructional development process.** This development is moving in two directions. On the one hand, some instructional technologists are developing expert systems that would place subject matter experts into the role of instructional developers and largely eliminate the need for professional instructional designers. This approach is analogous to the development of CASE (computer-aided software engineering) tools for generating computer applications (Jonassen & Wilson, 1990). The most advanced example of this type of expert system is "ID Expert" being developed for the U.S. Army at Utah State University (Merrill, Li, & Jones, 1990).

On the other hand, other instructional technologists are promoting the development of performance support systems (PSS) specifically for instructional designers. Systems such as the "ID Library" developed at The University of Georgia for Apple Computer, Inc. are intended to make instructional designers more productive by providing them with a rich database of professional guidance plus an associated kit of tools and templates (Gustafson & Reeves, 1990). In contexts requiring the development of interactive instruction, the PSS would be linked with authoring systems for generating interactive programs.

A more speculative sign of a future training revolution concerns **the development of intelligent tutoring systems (ITS)** (Polson & Richardson, 1988). Training with embedded artificial intelligence in the form of expert advisors or natural language processors may be commonplace in the 1990's, but prospects forthe development of full-fledged intelligent tutoring systems seems less likely. Current ITS prototypes have been developed in relatively narrowly defined military training contexts, and few corporations are investing heavily in the development of these systems. On the other hand, ITS prototypes are providing excellent tools for advanced research in cognitive science and learning theory.

Conclusions

Based on the complexities facing North American educators and trainers in the decade leading up to the year 2000, a number of predictions can be made with respect to information training technology:

1. Training will be delivered on a real-time basis, via workstations, skill-based, and delivered on a need-to-know basis.

2. The distinction between work and training will become increasingly transparent for all members of the workforce who use computers because of the development of powerful performance support systems.

3. Interactive multimedia will become the dominant mode of training, thereby providing students with accessible, modular, interruptible. individualized, and motivating instruction.

4. Models, procedures, and instruments for evaluation will be refined so that a comprehensive assessment of learner reactions, learning, transfer, and impact can be provided.

5. The instructional development process will be made more effective and efficient through a combination of expert systems and performance support systems that support both subject matter experts and instructional designers.

6. Intelligent tutoring systems will be enhanced primarily in terms of provisions for coaching or advisement and natural language processing.

This is not the first paper to prognosticate the future of North American information training technology in the year 2000 (cf., Gustafson, Tillman, & Childs, in press; Hawkridge, Newton, & Hall, 1988; Kemske & Weingarten, 1989), nor will it be the last. However, ultimately the utility of such futuristic thinking is not so much in the accuracy of the predictions as in the establishment of high, even optimistic, goals. In light of the complex array of problems confronting education and training during the next decade, those goals cannot be set too high.

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RESPONSE

Information Training Technology: The North American Perspective

by

Thomas Reeves

Response by

Alan F Holzl
The University of Queensland

Introduction

Thomas Reeves gives us the North American perspective on information training technology through listing a series of problems, or complexities, that will 'plague training throughout the 1990's and into the next decade.' He subsequently describes a range of technology-based solutions to these problems that are currently being developed by business and industrial trainers in North America. The following critique discusses these 'complexities' and the technology based 'solutions' put forward, and concludes with general comments on how the technology described in this paper may be applied to Australia and the rest of the world.

The Problems

Reeves refers to his training problems as 'complexities' and looks at future trends as well as the here and now. Most trainers would recognise some of these problems from their own work place and would have witnessed the trends, with some exceptions, occurring in their own country. Reeves provides a concise summary of these trends and presents a clear picture of the 'old and new contexts' for information training technology in North America. In his descriptions of these complexities, however, Reeves also raises issues which require further information.

One such issue is raised in his discussion of the increasing complexity of the workplace when he says that North American companies are struggling to catch companies like Volvo in Europe and Sony in Japan in developing team-based work and reward systems. As a group of training professionals we should be detailing why this is so, and how it can be rectified.

The third complexity relating to the entry level of personnel was quite surprising considering that the trend in Australia and many other nations is towards an increasing level of educational attainment among personnel entering the workplace. The questions should address with respect to this complexity, are those raised by the proposition that the workers will be more heterogeneous with more interest in self-development, career success and quality of life than job security, company loyalty and bringing home a pay cheque.

There is a statement with respect to the fifth complexity on the shortage of first rate trainers which says that human trainers are not efficient providers of experiential learning and infers that information training technology would be more efficient. Open debate on this one issue seems more than than appropriate in this forum.

Solutions

The first solution involves 'the integration of work and training via powerful workstations'. From the description provided by Reeves, this development is both exciting and innovative and raises the question of exactly how far away, in time and money, is the technology which will create ' a virtually seamless interface' between job situations and training materials? There is one concern about developments such as

Apple's ID Library and that is whether it is a solution looking for a problem rather than being developed as a solution to specific training problems.

When discussing interactive multimedia/hypermedia, Reeves says that 'The secret of its success lies in its ability to actualize the dimensions of instruction that research in cognitive science and adult learning have identified as effective and efficient instructional strategies. The practical application of technology to achieve success need to be more explicitly documented.

Conclusion

Although this paper is concerned only with the North American perspective, the reader cannot help but ask "What are the implications for my own country?" is information training technology, which has been developed in North America, in response to North American training problems and trends, able to be 'culturally transparent' and adopted, with minimal modification, into my own country? These questions can only be answered by the individual trainer with respect to their own country and their own list of unique training problems or 'complexities'. There can be no doubt that information training technology has the potential to solve many of our present and future training problems, and the free exchange of ideas between nations, as exemplified by this paper and the ITTE91 conference can only hasten this process.

FUTURE DAY

KEYNOTE ADDRESS

ONE

Dennis Kviz
Director
Compute Able Network

Dennis is the President and Chairman of Compute Able Network, Inc. based in Beaverton Oregon USA. Compute Able Network (CAN) is an international corporation that specializes in access to technology for persons with disabilities. Since its establishment in 1985, CAN has reached out in a global effort to provide the necessary products and services to those persons who require the use of computer technology in education, employment and rehabilitation despite the obstacles presented from a disability.

Kvis began his quest from sheet necessity while a special education teacher and consultant. Technology began to be an integrated part of the regular classroom environment, however, little of this technology was readily useful to children with disabilities. He observed the ingenious often isolated attempts of teachers and others to integrate their students to the computer world. The first effort by Kviz in 1985 was to bring these teachers, parents and engineers together with a national conference to 'network' their talents and accomplishments for the benefit of all. The response was overwhelming and established Compute Able Network as a national network for information on adaptive computer technology.

1988, CAN was invited by authorities in the Soviet Union to be part of a delegation to Moscow and Leningrad to assist disabled Afghanistan Veterans. This visit led to agreements designed to make technology available to Soviet citizens with disabilities, veteran and non-veteran alike. The most significant accomplishments in the Soviet Union, to date, are the establishment of a program to revitalize their rehabilitation services and 40,000 computer systems with adaptive devices. Kviz has spent the last two years developing a spirit of international cooperation in adaptive computer technology including Australia, Sweden, Norway, Japan, Austria and several Soviet republics.

TECHNOLOGY: A NEW DISABILITY?

Dennis Kviz, MEd
President/Chairman
Compute Able Network Inc.

Computer Able Network (CAN) was established in 1985 as a national technology information network for persons with disabilities and their service providers. This includes hospitals, school districts, colleges, universities, and governmental agencies. These service providers became aware that technology could provide solutions for various limitations CAN's charter was to provide these, non-technically trained, providers with the information necessary on the available adaptive technology. These services provided were primarily by telephone, local workshops and by CAN's two national conferences.

Since then the Company has continued to broaden its original charter and expertise. In July 1987 CAN recognised the need to offer more than mere information to our clients. The complex nature of technology, combined with eh proliferation of technology in both the work place and education vastly increased the need for services. In addition, the proliferation of adaptive technology solutions increased from approximately 50 devices, when CAN began providing services in 1985 to over 1500 by mid 1987. CAN grew along side this emerging technology, riding the knowledge crest in the adaptive technology growth curve. This proliferation and demand for technology when combined with the skill-set necessary to make intelligent knowledgeable decisions creates a significant challenge for the adaptive computer technologist. These end-users have a broad range and combination of disabilities, needs and environments. It is easy to see how a service provider such as an occupational/physical therapist, speech pathologist, vocational rehabilitation counsellor, or social worker, who lacks training in adaptive technology, would be at a serious disadvantage. It became absolutely necessary to provide a holistic solution to this challenge including thorough evaluation, system design and installation, and training. This systems approach became our vision for true accessibility to technology without barriers and uniquely positioned CAN as one of the few full-range, full-service suppliers.

Recognition of the potential resource of skilled labor that persons with disabilities, could provide, have led governments, corporations and educational institutions to invest in programs to train and equip these individuals with computer systems. However, the skills and personnel resources of one company cannot begin to directly meet the needs of the tens of thousands of persons with disabilities. Our approach is helping to equip others to provide technology to persons requiring it. We stand ready to share the knowledge we have acquired with others, in ways that best serve the needs of persons with disabilities.

Since late 1987, CAN has had many opportunities to take our vision beyond the boundaries of the United States. The willingness to stretch has transformed CAN from a regional company into a recognized world leader in adaptive technology.

CAN is responding to an international demand that appears, in many cases, to be approximately 3 to 5 years behind the more developed nations. International requirements for the development of adaptive computer technology are very similar. The needs of a physically impaired person in the United States and the needs of a physically disabled person in Australia or Zanzibar are often similar. The paramount expressed need encountered by CAN has been for the provision of an in-depth training program spanning all facets of adaptive computing.

In 1988, CAN was invited to be part of a special trade mission to the Soviet Union. This trade mission was designed to bring together specialists in services to disabled veterans. The Afghanistan conflict resulted in large numbers of veterans disabled either physically and/or emotionally. CAN's acceptance of the invitation was conditional on the additional possibility to work with organizations also serving the non-veteran disabled. The Soviets were happy to accommodate our request.

This trip included visits to various facilities for working with disabled veterans including Burdenko Military Hospital, Moscow Orthotics Clinic, Inva Technica and the Military Medical Academy in Leningrad. I will go into much greater detail concerning the results of this trip later in my presentation.

CAN has held detailed discussions with the National Labour Market Board, which has jurisdiction over rehabilitating the employable disabled adults in Sweden. The Scandinavian community is recognized as an innovative leader in disability programs. CAN has signed an agreement with a large corporation based in Sweden, for the establishment of a cooperative effort to provide access to adaptive technology in that country. This company has a major contract with the National Labour Market Board for the implementation of adaptive technology in the work place. CAN provided a week long training seminar in Sweden for specialists from the NLMB. Agreements are being negotiated to market and distribute several unique products from Sweden into the United States, Canada, Australia, Soviet Union and Japan.

CAN met with the United Nations while attending an international conference held in 1989 in Vienna, Austria. At the conference, the overwhelming potential of the international market was evident. CAN representatives met with delegates from over 20 nations, all expressed an obvious need for assistance. This need was further verified in meetings with Mr M Sharif, officer in charge of the Social Development Division, United Nations Disabled Persons Unit, headquartered in Vienna. They have requested that CAN assist to assemble an authoritative information resource on adaptive computer technology. This cooperation will ensure worldwide access to information on adaptive technology.

At numerous conferences attended by CAN during the last year, we met people from many countries including Israel, Republic of South Africa, Norway, Sweden, Australia, Canada and Japan, who validated the need for information and training internationally. We have received mail or telephone inquiries regarding our services from numerous countries including Australia, Japan, Brazil, Mexico, Saudi Arabia, New Zealand, Belgium, Austria, Germany, Hungary, France, Norway, Ireland, Canada, and others. The potential for the expansion of services to other countries is clear. For these projects to come to fruition many participants will be required and the growth carefully orchestrated.

CAN's international work in this field has led to opportunities to take on additional roles, primarily in the accessibility of adaptive computer technology world-wide. Some of these opportunities will be described later, as will a challenge to participate.

The Technology

History

The early work on adapting computers for persons with disabilities began in 1980, with the focus on modification or alternatives to the keyboard. The standard keyboard is difficulty or impossible for many who have physical disabilities.

Around 1984, personal computer manufacturers strived to make the computer more 'user friendly' to the non-disabled market. These improvements made the computer more marketable to the average person and simultaneously provided a variety of opportunities for access to persons with disabilities.

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Speech recognition or input systems, which allow the computer to respond to the spoken command, were developed because most business executives would prefer not to type. They systems provide a method of input to the computer for an individual with no use of their hands. Similarly, the development of speech output systems to make the computer more user friendly also help blind persons to recognize, through speech synthesis, what appears on the computer screen.

Personal computers are becoming easier to use due to a major thrust in software design to simplify operation. Less and less knowledge is required about programming or operating systems with the advent of menu, window, and mouse driven programs.

Specially designed features for the disabled are now being developed that provide necessary adaptations to the computer environment for those disabilities which are not so easily accommodated by main stream technology. Many specially designed adaptations are possible because of technological advances in the computer industry. Others are created due to the demand created by the awakening needs of persons with disabilities as they see what computers can do to enhance their quality of life.

Description of Technology

Computer utilization by persons with disabilities falls into four basic categories:

A. Adaptive input systems for persons with limited fine motor capabilities. This includes transparent keyboard emulator devices such as optical pointers and scanning devices, expanded keyboards, voice input, and keyguards. Another area of technology available to enhance usage by this population is the development of artificial intelligence(AI) which can anticipate and predict word choices based on minimum text input. AI programs can improve the typing rate of a person with a fine motor limitation by 75%.

B. Adaptive output systems for persons with limited vision. These devices include enlarged image displays, tactile scanners, speech output, and Braille output.

C. Adaptive devices and software for persons with speech or language disorders. These devices include augmentative communication devices for persons who are speech impaired, speech recognition telephone devices for the deaf (TDD's), and language-accommodating software for persons with hearing difficulties.

D. Adaptive software for persons with cognitive based-problems. Persons with learning disabilities, mental retardation, and the gifted have available specially designed software for learning and employment that either reduces the potential for error or presents challenges for the gifted.

Another way of using microcomputers would be an an input or output device on mainframe and minicomputers. This is especially important because few adaptions are produced for the operation of terminals that provide the input mechanism for the larger mini and mainframe computers. These computers are well entrenched in the corporate and government world. The adaptive devices installed on a microcomputer acting as a terminal are the best way to keep these employment options open for persons with disabilities. Mainframe and minicomputers also provide access to a wealth of information and services such as electronic mail, research databases, centralized word processing, computer assisted instruction, etc.

As we move further into the 'paper-less' information age, more and more information exists only electronically and the management of this information requires manpower. With the proper adaptive computer technology, the disabled population will be ready and able to provide these manpower needs.

Training Needs

Training is primarily for those persons who employ or provide services to persons with disabilities, This training should enable these individuals to develop an awareness of disability access issues and accurately configure the wealth of adaptive technology into a system ideally suited to meet the needs of each person served. We are developing several training courses to teach a variety of skills, and technical competence.

Computer/Disability Orientation

A basic orientation on the operation of computer systems and the specialized access needs of persons with disabilities.

Basic Operation of Microcomputers

Orientation to hardware and software technology.

Rationale for Disability Access

Legal, social and employment issues.

Disability Ergonomics for Computer Access

Trainees learn to address the orthopaedic aspects of disabilities, the job requirements and analysis, and work-site considerations.

Assessment of Clients Computer Needs

A detailed evaluation of a specific client's needs and capabilities through the use of work-site assessment. The assessment is based on the requirements of the institution and the accommodations necessary for successful access to the electronics used.

Consideration of Medical History\

Examination of the medical aspects of disabled clients relative to their successful use of adaptive computer systems.

Development of the Employer Technology Access/Accommodation Plan (ETA/AP)

Developing recommendations for the employer in the area of equipment, workstations and training including:

A. Assessment of the Work-Site: A thorough analysis of the facilities relative to the compliance with the requirements of accessibility issues. Issues addressed include physical layout of the facilities and workstations, general architectural accessibility and ergonomics of lighting acoustics and traffic flow.

B. Assessment of the Electronic Equipment: Analysis of the specifications and configuration of existing computer equipment, software applications and the input and output devices. This entails the types of hardware environments (AT,XT,Macintosh, mainframe, mini, other), their capabilities (RAM, BIOS, expansibility, drives, speed, video graphics, peripherals and types of available ports) their connectivity (LAN, WAN and types of networking systems).

C. **Assessment of Personnel Training Requirements:** An evaluation of the background training and experience of the support staff to deal with the adaptive technology under their control. This includes recommendations for any additional training or outside support required to maximize the use of the accommodations in place and considered necessary for future implementation.

Development of Individual Access/Accommodation Plans (IA/AP)

The student learns to incorporate recommendations for the individual into the current facility. Providing effective access to the workstation for the client through the occasional modification of the workstation.

Hardware Assembly and Installation

Developing competencies concerning system configuration, hardware assembly, and adaptive peripheral installation.

Software Selection and Installation

How to select appropriate software for the client, based on his/her immediate needs and long term objectives.

Client Instruction

Develop competencies in post-installation support, such as follow-up planning, primary technical support, troubleshooting and upgrade support.

The Soviet Union

CAN has participated in several trade missions to the Soviet Union and has entered into agreements to provide training and computers to entities serving the disabled within the Soviet Union. In addition, we are in negotiations with several other Soviet entities including the Ministry of Higher and Special Secondary Education for the Russian Republic, preparing to order 20,000 computers and assistive devices. We also have received two joint venture proposals for projects designed to assist persons with disabilities. The necessity for these services is not because of Glasnost and Perestroika, yet these radical political changes have made possible the implementation of this very critical challenge. The resulting formal agreements with the Soviets are authorized and signed by highly respected persons from four separate entities including the Soviet Academy of Sciences, Ministry of Special Secondary and Higher Education for the Russian Republic, Foundation for Social Inventions, and the National Computer Club of the Soviet Union.

CAN holds an existing contract with Pomosch, an organization which has 108 factories within the Soviet Union employing the disable, for 20,000 to 40,000 computers, adaptive systems, training, supplies, and spare parts. The request for this technology is the primary reason for the development by can of the Ability Center concept. It is critical that the very necessary underlying rehabilitation services are provided. These services will ensure that the client has the best chance of success with adaptive technology. To this end CAN agreed to facilitate the development of a national rehabilitation center in Moscow.

The Moscow Ability Center

The Ability Center concept was developed by CAN while in the Soviet Union in 1988. CAN was invited primarily to share our expertise in the use of computers by the disabled. Other delegates represented several different disciplines including experts in post-traumatic stress disorder (PTSD), veterans' services, prosthetics, wheelchairs, disability rights, accessibility issues, and adaptive computer technology.

The Ability Center is dedicated to the full integration of disabled people into society. This is accomplished through the provision of comprehensive services provided by experts in the various disciplines at one site. The delegates who participated in the fall 1988 trip, represent some of the areas of expertise necessary to ensure that disabled persons obtain the services required to become more fully functional members of society. In addition, CAN has recruited the support of experts in other disciplines. These experts include special education across a variety of disabilities, vocational rehabilitation and training to assist with job placement; occupational therapy to assist in development of fine motor skills; speech pathology to assist with augmentative speech; physical therapy to assist with gross motor skills; and sports and recreation therapy to assist with the development of leisure activities.

In establishing the Ability Center in Moscow, it is necessary to involve individuals with disabilities and the professionals who serve them in the initial and on-going planning and policy development. Persons with disabilities know which service they want and need. Many countries, including the United States made the mistake of not including the disabled in the initial planning of services. To avoid this mistake in the Ability Center we are encouraging persons with various disabilities to participate in the initial planning phase.

Our objective is to support the Soviet's development of their own systems, personnel, training and unique services required for their situation. The Ability Center will be unique.

CAN has moved forward with Pomosch in the planning of the Ability Center. Numerous formal offers of support for consultation, training, and resources from the United States and several other countries have been committed.

Consultation

Consultation is offered in many areas of services for the disabled. The following service consultations have been offered: special education, vocational rehabilitation, prosthetics, adaptive computer technology, adult education for the disabled, readjustment counseling, social services, disability rights, psychological stress, information services and other related services. Included in one letter of support is a resource for Russian Braille translation.

Training

Training programs are proposed in prosthetics, special education, and adaptive computer technology, also several professional area training opportunities. This training is proposed by Hittenbergers Prosthetic Service, Lewis and Clark College, Compute Able Network, and Oregon Health Sciences University. These training sessions would be held in the United States.

Professional Exchanges

Exchanges of professional staff are proposed for the benefit of both countries involved. As the Ability Center becomes known and the needs are fully recognized, many professionals will be seeking to contribute time as consultants and to develop exchange programs. There are many rehabilitation professionals worldwide who desire to travel to the Soviet Union. The Ability Center could serve as a place to do their studies and exchange ideas with Soviet colleagues.

Conclusion

In conclusion, technology has the capability to enhance our lives, if we can obtain the skills necessary to master it. For a person with a disability there are certain barriers to successful use of computers. Through the advantageous networking of available resources significant gains can be made to eliminate these barriers and ensure that technology does not become a new disability.

RESPONSE

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Technology: A New Disability

by
Dennis Kviz

Response by

Dr Michael Macklin
The University of Queensland

Late in 1989, I and my wife had the opportunity to spend a few days at the headquarter of Compute Able Network in Portland, Oregon. We were impressed not only by the work that was being done there and which Dennis has outlined his paper but also by the calibre of the people who were doing the work.

Compute Able Network's basic philosophy of 'empowering' is as critical to the success of the work that Dennis has outline - unfortunately in a very cryptic form - as in their detailed understanding of networking of technology.

I mention this at the outset because Dennis' paper starts by raising the question of whether technology has the capacity of creating yet a new disability. Undoubtedly, this question has been raised in Dennis' mind by his own early work on adaptive positioning in which the concern is to avoid creating a disability as a result of the body's own reaction to some other disability. In many ways, this early work of Dennis Kviz stands as a metaphor for the way that technology can also create new problems on top of old ones without furthering the capacities of people with disabilities.

Christopher Newell has put the situation clearly in his recent article on 'Capturing the High Ground in Cioethics and Disability'

> '...severe disability does not necessarily mean a tragic existence. Rather it is inadequate and inappropriate support services which handicap people with disabilities and serve to create a low quality of life. Many examples exist of people with disabilities who were held to be 'better off dead', surviving to be more happy and content than many able-bodied professionals with ulcers and potential triple-by-passes.'

Dennis' team clearly do not accept that common view that having a disability inherently predisposes one to a life of low quality and value. I particularly warmed to the very positive attitudes under which Compute Able Network operates. They are the opposite to the narrow norms of what it is to be a person in our society. I am talking here not only of the advertising industry's promotion of certain body types buy also of the assumptions underpining so many promotions. A recent example that comes to mind is the government billboard advertising campaign showing a young man in a wheelchair with the warning to drink drivers that 'there is no future' if you end up in a wheelchair. Good intentions do not excuse this extraordinary uncouth error. The message is false and pernicious as Dennis' work attests. Of course, one does not people being so injured that they end up in a wheelchair. However, if it happens technology can assist in developing a future which contains not just basket weaving but accounting, not just macrame but being a company director.

This is particularly important since working towards adequate education and training services for people with disabilities means that we are interested in autonomous and successful lives for people with disabilities and not the perpetuation of dependence.

The type of work that Dennis Kviz has been doing so successfully in the USA and around the world has been undertaken by others in a more limited fashion. For example, here in Australia the Special Education Technology Information System put together by

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Peter Pryce-Davids from Queensland and funded by the Department of Employment, Education and Training is a vital resource. It is obvious, however, that more links need to be established in order to take advantage of the two major elements of knowledge and training that Compute Able Network offers. As Dennis points out, advantageous networking of available resources will ultimately ensure that technology does not become a new disability.

I have already said that the paper is written in a cryptic style. Having had the opportunity to sit down and discuss for hours the issues that Dennis has only touched on in his paper, I would hope that others, better placed than myself to make a difference, can appreciate the vision behind the development of Compute Able Network from a voluntary network to a small west coast American company and then onto an organization assisting people with disabilities in European Community and the USSR and finally internationalise the network through the United Nations.

As is again obvious from his paper, Dennis is not an armchair theorist - although there is a place for such activities - but rather he is a practical visionary. He saw what was possible and was willing to put in the effort to achieve it.

Although Dennis has not mentioned the fact, it is important to realise that Compute Able Network is a private company. This means that its establishment and operation involves personal financial risk but it also means that the services which Compute Able Network offers are under the control of the people who use them. In other words, the model being used is one where the financial resources belong to the people with disabilities who then determine what they will purchase and when. Provided the society is responsive and makes the financial commitment, this model is vastly superior to the one where a bureaucracy determines what is best.

Dennis' vision of 'empowering' for people with disabilities is, I believe, a fruitful approach for networking in general. The vision for networking in education and training must be about giving people the capacity to do what they want to do; it must be based on an acceptance that education and training operations are at their most productive when they are desired by learners. 'Do-goodism' has had its day. Dennis recognized many years ago that the do-gooder was in danger of being run over by a stampede of wheelchair owners going their own way. Dennis decided that the future lay not in building a fence to corral but rather to assist in electrifying the chairs, as it were, to enable them to go where they want to go more efficiently. That is not only good policy but good education and effective networking.

Technology will be a new disability is the barriers to successful use of computers is allowed to hold sway. Networking of knowledge and information is vital. It is something which that mythical beast, the market, does not do well in the area which Dennis Kviz works but he and his team have been able to harness the best of the development system so that it does work. I look forward to an Australian link in this international enterprise.

FUTURE DAY

KEYNOTE ADDRESS

TWO

THE HORSE OR THE CART?

Apple Computer Representative
United States of America

Abstract

During this session of the conference Apple Computer and Logical Solutions will present visions of the potential future of information technology. This 'private briefing' will demonstrate the potential for the future of the technology, with a view to outline the horses of the near future. Hopefully in so doing conference participants will be able to build better carts-to design training and instructional systems with the confidence that the horse power they need is being developed.

The information technology business' is faced with the constant task of attempting to grasp the ethers of the future. The fundamental nature of information technology is based around perpetual change, it is not sufficient to find 'the right solution' and then rest assured for the future. For every technology being implemented, many more must be under development, paving the way for the next wave-the latest innovation And this is where the delimma lies.

One would hope that the directions for future technologies would be tightly linked to the needs of the end users, that is, that the future of technologies should be needs driven. Yet this complex field of information technology must always look further than the present. It must go beyond anticipating the future needs and, in many cases, create the needs. For example the notion of real time high resolution video on a personal computer has now become a possibility. This is due to the availability of low cost large storage devices, computers with very large RAM capacities and the emergence of high speed video compression technologies. The need for the application did not directly drive the development of the higher capacity computers, it occured as a result of their availability.

Those in the computer world with an eye to the future must design their horses (information technology devices) to carry carts (applications) that do not exist. Cart manufacturers best know the loads they need to carry, but must wait for the horse to appear before they can harness its power.

Apple Computer is a technology company that has always directed significant energies into predicting the needs of the future. Consider the first Apple Macintosh released in 1984. The revolutionary operating environment(the graphical user interface) integral with that computer has only now become the sought after standard in the 1990's. All major emerging computer operating environments aspire to the simplicity and consistency achieved by Apple some seven years ago. conservative estimates suggest that the competitors are still years away from achieving that 1984 benchmark.

Apple cannot rest there. The exponential rate of development in computer related industries in an increasingly competitive market forces Apple to pursue the future.

The increasing importance of the focus on the needs of the individual, always uppermost in the Apple philosophy, will continue to direct the future developments.

INDUSTRY DAY
KEYNOTE ADDRESS
ONE

David Cormack
Manager
Operations Training Services
QANTAS

David has been in the aviation industry 34 years of which 26 has been in training. Starting in the Engineering and Maintenance Branch as an apprentice maintenance engineer David transferred to Flight Operations Training in 1965 to help set up the QANTAS Cadel Pilot Training Scheme. He was responsible for preparing and conducting the training programs for aircraft systems control and operation, aerodynamics and aircraft loading systems.

In 1969 he started the training development group in preparation for wide body jet aircraft and was responsible for the introduction of the 747 technical crew ground training in 1971. Since that time David has continued his training activities for flight crew and maintenance engineers for all QANTAS aircraft types including the 767 and 747-400 aircraft.

As a member of the Air Transport Association's flight crew and maintenance training panels and the Boeing Company CBT task force, David has worked with international airline training groups and equipment manufacturers in formulating training and equipment specifications for the introduction of glass cockpit aircraft.

He has been very active in the introduction of CBT with the use of high resolution screens and graphic displays using touch screen and digitised audio applications that meet the specific needs of the industry.

INFORMATION TECHNOLOGIES AND TRAINING ISSUES IN QANTAS

David Cormack
Manager
Operations Training Services
Flight Operations Training

Introduction

The QANTAS Flight Operations Training is located on the QANTAS Jet Base, Kingsford Smith Airport, Sydney. Training and checking activities are conducted on a twenty-four hour basis, seven days per week in five different buildings. The main training centre contains the training administration and support groups plus computer equipment ranging from carrels, computer based training systems through to full flight simulators.

Training and checking is conducted for three specific populations. Technical aircrew, our pilots and flight engineers, technical and cabin crew emergency procedures training and aircraft maintenance engineers.

The training group reports via the Director of Flight Operations and Chief Pilot to the Deputy Chief Executive Officer, Technical. The group is responsible and accountable for training and checking of personnel to maintain airline operations under the various Civil Aviation Authorities' regulations and orders for the safe conduct of airline operations. As well as these regulatory requirements the Company also specifies training and operating standards to be complied with for safe and efficient aircraft operations. These are monitored by a Standards and Safety group for technical and cabin crew and a quality control group for maintenance engineers.

Supporting the main training stream are three groups;

Training development, consisting of instructional system designers, staff development facilitators, graphic artists and technical development officers who provide the development and/or modification of new or existing training packages, courses or programs.

Training resources, provides services for technical library reference, examination libraries and control, training manual publications, audio/visual production for 35mm slides, audio for cassette tapes and CBT plus video production, editing and duplication. Training services, provides training administration, purchasing, forward planning, licence issue and records, training records, external contracts, property planning and control plus training facilities and equipment maintenance.

Technical Aircrew Training

Technical aircrew training covers all aspects of training and checking through three phases; ground, flight simulator and aircraft. Each phase has a specified pre-entry standard for the course or courses required within the phase with the exit competency meeting the pre-entry criteria for the next phase course or courses. The total sequence of courses make up the training program for a specific technical aircrew requirements.

QANTAS does not train pilots for ab-inito or initial private and commercial licence issue. Pilots are employed with a commercial licence and instrument rating and specified minimum number of flying hours. It is from this position that our training starts.

Training programs cover pilot under initial training where-by new hire, low experience pilots are phased through a series of courses to meet Second Officer licence issue on either 747-200/300 series, 767-200/300 series or the 747-400 aircraft. Experienced crew-members are also trained on these aircraft types as Second or First Officers or Captains. Additionally programs are conducted for pilots on a specific type to be promoted to the next rank on type or cross trained onto another aircraft type and also promoted to a higher rank. As well as aircraft licence issue training all crew members must attend a Cockpit Resources Management course as part of their training.

Ground training covers all aspects of aircraft systems, their control and operation plus subjects such as performance, flight planning, navigation and systems, aircraft loading, fueling malfunction reporting, crew co-ordination and co-operation. The courses are divided into two aspects, academic and practical. Academic si the industry terms that covers theoretical presentation on subject content by various delivery systems that in QANTAS are mainly stand-alone, self paced presentation methods. Practical training which turns the theory into practical application is conducted using various computer controlled devices from CBT through flight management system trainers to fixed base of flight simulators. The ratio between academic and practical training varies with each aircraft type with every effort being made to maintain as high a practical content as possible. At the end of the course each crew member is checked by written examination, 80% pass mark with some subjects 100% and practical check in a simulator to ensure they meet the 'next phase' pre-entry criteria.

Flight simulator training provides the total crew and line operations concept of the training sequence. The flight simulator, as the name implies, provides total simulation o the aircraft and its systems response to the flight and performance envelop of the actual aircraft. The simulator is fitted with a computer generated image visual system that provides the visual aspects of each airport nominated for the training exercise including day, dusk, night and dawn images and variable for any specified visual range (zero vis. to unlimited) or weather conditions. The total cockpit environment is created by use of actual aircraft instruments, panels, seats and equipment in true aircraft configuration. A six axis motion system enables the flight regime to be experienced during normal and non-normal flight and system conditions. An audio system covers all 'noise', actual and subconscious that occurs in the aircraft.

Training and checking sequences cover every thing from basic handling skills to total skills under any condition with or without aircraft system malfunctions with the crew working as a co-ordinated team sharing and resolving problems. On-board video camera enable each sequence or the entire session to be recorded for play back during debriefing sessions.

Aircraft training is conducted as either base or route training. Base training requires the aircraft to be taken out of commercial service and used for pilot training in the take-off, circuit and landing phases under varying configurations and engine powers. This is a very expensive method of training/checking and is mainly conducted in flight simulators that are accredited for this purpose as 'Zero flight time' simulators.

Line training consists of a Training Captain working with a pilot under training/checking on a commercial service. These sequences are used for training of crew member of various ranks or checking of crew for their licence renewal requirements.

Given the technologies available to use today the majority of training and checking is conducted in the Flight Operations Training Centre using computer controlled simulated training devices.

Safety and Emergency Procedures Training.

Technical and cabin crew Safety and Emergency Procedures training and checking is also conducted in the training centre. Regulatory and Company controlled, these programs require both crew categories to be trained and checked in all aspects of aircraft and passenger safety through all phases of flight.

Courses cover both initial and aircraft type qualification and over such aspects as safety procedures, fire fighting, aircraft evacuation procedures on land, ditching procedures of water landings and evacuation, inflight emergencies such as fire, decompression, hypoxia, bomb search, hijack and deranged passengers.

Theoretical and practical training sequences cover all aspects of the training with a 30% theoretical, 70% practical content as an average for each program. Theoretical presentation is by audio/visual packages in the training room or learning carrel and practical training using an evacuation trainer, ditching trainer, door trainers for the 767 and 747-300/400 upper deck and aircraft slide/raft and emergency equipment. Pilots receive additional training in a passenger/freight 'combi' fire fighting trainer. Examination pass mark is 80% for most subjects with a 100% pass on critical subjects. Practical assessment is on a pass/fail criteria.

Crews are checked annually for proficiency by theoretical and practical checks in the training area.

Additionally cabin crew are checked approximately every thirty days at a Pre-Departure Check. This occurs when the cabin crew members reports for duty and is ready to go out on service. A computer controlled scheduling system identifies when the person is to be checked. The PDC system has a pass/fail criteria. Checking currently is conducted by an emergency procedures instructor on a one-on-one basis and covers theoretical and practical aspects of aircraft safety. Failure means that the person is withdrawn from service and a stand-by crew member called out to replace them. The failed crew member goes through a counselling session to identify the reason for failure and the outcome determines the next course of action. Once proficient the crew member returns to the duty roster.

The first quarter of 1991 will see a computer based checking system introduced into the system. Operating from a file-server, the system uses a multicoloured touch screen to provide specific questions based on the aircraft the cabin crew member is about to operate and that persons past performances. Questions can be multi-choice, graphic displays or a combination of both. The questions cover all aspects of safety in twelve different fields. The test is compiled by a random access generator within the file server. The keyboard and CPU are not seen by the crew member, only the touch screen. Each person is identified by use of their ID card which is magnetically coded for each individual. Passing their card through a card reader automatically identifies and verifies the cabin crew member and activates the PDC system.

Licensed Aircraft Maintenance Engineer Training

QANTAS has two training groups for maintenance engineer training. The apprentice and skills training group and the licensing training group. Because we are responsible for all licensing training it is the latter group for which Flight Operations conducts training and checking.

Broadly there are five different licence categories for each aircraft type, engines, airframes, electrical, instruments and radio. Due to the impact of modern aviation, technology found in aircraft like the 767, A320 and 747-400 which use digital avionic systems and computers moves are being made to combine these categories into two areas, mechanical and avionics. The licences are issued by the Civil Aviation Authority to individual maintenance engineers upon their completion of an approved training program and specified practical experience on the aircraft for the category. The licence enable the engineer to conduct servicing and maintenance on the aircraft and sign for such work as being correctly carried out under the regulations.

As with technical crew training there are pre-entry standards for each course. Before a maintenance engineer can qualify for a type course, that person must hold various basic licenses within the category. As such our Engineering Training group conducts both basic and type licences courses for the aircraft operated by the Company. Training is also conducted for aircraft type operate day other airlines that QANTAS staff service at various airports. As well as training our own staff we also train staff from other airlines to maintain our aircraft.

Maintenance engineer training is mainly conducted in the training room as it has a high theoretical content on involved and complex subject matter. Delivery is usually by 35mm slide or overhead view foils supported by video presentations and a comprehensive set of training manuals issued to each person. Practical training is conducted using computer based training, maintenance and flight simulators. Practical training is also conducted on the aircraft by our instructors and under supervision of experienced engineers. The ratio between theoretical and practical training approximately 75/25. This, in part, has been due to the lack of instructional design concepts and strategies within the industry and some industrial hesitation and suspicion towards advanced methods. Again, due to the technologies occuring with the latest aircraft types there has been considerable effort applied in the last three years to reverse this trend. Examination pass mark in 70% on all subjects.

The International Aviation Training Forum

Given the high costs involved with aircraft purchases, the subsequent training costs of airline personnel and the various regulations applied by different aviation regulatory bodies throughout the world, there has been a concerted effort between the aircraft manufacturers and the worlds airlines to standardise training programs where-ever possible. The Boeing Commercial Airplane Company has been very active and supportive to the industry and airlines in these areas. They have committed time, specialised staff and money in establishing many of the advanced training methods used today.

Technical crew training is the most expensive in terms of the trainees and the equipment and it is here that most of the effort has been directed since the early seventies. Concepts such as: Specific Behavioural Objectives, Crew Performance Objectives and Cockpit Resource Management have been developed. Training delivery has gone from the 'traditional' class room and view foils through to Radio Visual Tutorials in the classroom followed by the use of Learning Carrels. Computer Based Training is now being developed for some of the current aircraft and definitely for future generation aircraft. The development and use of fixed base and flight simulators has been rapid with aircraft training costs and associated environment problems forcing these developments.

The International Air Transport Association and Air Transport Association have both formed training committees that are attended by airlines from throughout the world. These committees in conjunction with aircraft manufacturers have developed training specification and delivery methods that meet most of the regulatory and airline requirements for technical crew training.

In recent years the maintenance training advisory committee has been formed to defined the present and future training needs of the world's airlines and still meet regulatory requirements.

Given the advent of computer based training the airline industry was faced with the problem of identifying hardware, software and courseware standards that airlines could use. This was brought about by the competition between the CBT vendors and was getting to the situation where an airline needed a different set of hardware.courseware for each aircraft manufacturer. The outcome was the Aviation Industry Computer Based Training Committee (AICC) which worked with the aircraft manufacturers, airlines and computer vendors to define a set of guide lines for all to follow and enable any courseware to run on a wide range of equipment.

QANTAS Flight Training has been very active in working with these committees on training for technical crew, maintenance engineers and computer based training.

The QANTAS Approach to Training

Given the three different areas of training conducted by Flight Operations each with their own unique needs, cultures, industrial agreements, technology, experience, education and age ranges, QANTAS has developed its own approach to delivering training/checking that meets the Company standards, regulatory requirements and cost efficiencies.

As an international airline that operates twenty four hours per day on a world wide basis training and checking has to be conducted with minimum disruption to airline operations. We also have to operate on a high technology base using equipment that is very expensive to buy and maintain. Taking a person(s) away from their normal work place causes disruption and is accompanied in many cases by high staff release costs as well as training costs.

On this basis our approach has been to provide training that is as cost efficient as possible, maintain safety (our highest goal), keep the training as short as possible and to train people in their work environment by practical applications where-ever possible. To this end we have made large investments in training equipment supported by a dedicated and professional team of instructors highly skilled in their own specific fields. We have also invested heavily in training development staff and strategies to enable us to achieve these goals.

One of the difficulties in achieving our goal of training people in their working environment is the high cost of equipment such as flight simulators which at today's prices cost approximately thirty million dollars each (A$30M). This in turn requires us to achieve maximum utilisation of equipment by conducting training and checking on a twenty four hour basis where-ever possible.

We have also committed, where possible, to conduct theoretical training on a self-paced stand-along basis which we have found to meet both the needs of the trainee and the Company. To this end we have a high use of carrels and are gradually increasing our use of CBT as courseware is developed.

The carrel is designed to deliver Audio Visual Tutorials to technical or cabin crew on a demand basis. The system is designed around a high speed commercial audio tape deck that is interfaced with a micro computer. The cassette tape, as well as having the verbal delivery, also contains digital coding that operates random access projectors. By using this method we avoid any problems associated with frequency pulses causing projector(s) to change slides at the wrong time, tape stretch or loss of synchronisataion between audio and visual. Trainee control is by a hand set that has sign-on control, projector and tape control, fast forward or reverse and automatic reset capability.

The carrel also allows linear or branching applications for single or dual projection presentation depending upon the instructional design concept. At the start of each tape a series of codes automatically identifies the specific training package and aircraft type to a computer that monitors all carrel operation by use of a Computer Managed Instruction system. The CMI also allows trainee enrolment and monitoring. Data is constantly recorded from each carrel and a data base maintains information on all aspects of training conducted. This data base is used for training package validation and cross-checking on package performance NOT trainee performance.

When a crew commence a training program they are assigned a carrel for their own use plus a set of packages that make up the course they are taking. The trainees have exclusive use of this unit and are not held to set report times, rather they define their own times that fit in with their overall training program and simulator report times. A services group and the instructor assigned to train the crew track the preferred use time of the crew. Carrels are also supported by CBT systems that also use CMI to provide data on training performance.

The only hard report times that the crew have are on the practical training devices such as flight management systems trainers, emergency procedures trainers, fixed base and full flight simulators. In this manner the crews can decide their own start times for academic training and set their own pace on the carrels and CBT systems. each practical training sequence has its own prerequisites as far as specific carrel packages that must be completed prior to the hands-on session.

One aspect of this training approach is that contact must be maintained with the trainee during the carrel/CBT phase of training to ensure we are aware of their needs and that they do not think that they are being machined trained. This aspect which we call 'hand-holding' is vital for this type of training delivery method.

QANTAS has had to design and/or build many of its own training devices. This has occurred because of our own specific training equipment requirements that were not available in the market place. Examples of these are our 767 and 747-400 flight management system trainers, our 767 maintenance training simulator and our upper deck door trainers.

The Future

We will continue to research and develop our forward training strategies and systems. Computer Based Training equipment is only now starting to provide the tools and equipment that we need to meet out on-going training program development. Items such as learning styles, screen and icon design, use of music for training and advanced training methods and delivery systems are all on the agenda. All that we need are time more time and ,money, we have the enthusiasm.

RESPONSE

Information Technologies and Training Issues in QANTAS

by
David Cormack

Response by
Margaret Berenyi
Department of Lands

Introduction

David's paper has clearly illustrated the diverse role which information technology plays within the Qantas training and education strategy.

Since the early 1970's great advances have been made in the areas of Information Technology. The advent of powerful microcomputers and the development of sophisticated computer graphics capabilities has caused a revolution within the entertainment market and is now making it's presence felt in the Business Applications market. Add audio and video to this and we can significantly enhance our ability to receive, process and act on information.

The main reason for the adoption of information technology in the training regime is its cost-efficiency, in terms of both time and money. As shown, within Qantas, the use of flight simulators which cost around $30 million can be justified, as the alternative would involve factors such as, greater downtime for staff, travel time for instructors, downtime for aircraft from commercial operations, and not least the increased safety risks.

The concept of high technology training (HTT) covers the broad spectrum of activities from simulators to computer based training modules to teleconferencing. Daniel recounts examples of several companies which illustrates the benefits they have gained in their use of high technology training methods. Examples include:

1. When the Computerland retail chain (USA) decided to introduce the Amdek monitor into it's range of products, the issue of training the service personnel loomed large. Traditional training methods would have entailed months of long training sessions and extensive travel for trainers and technicians. Delivery costs of the training equipment alone would be high. The introduction of the monitors into each store would be necessity need to be staggered, thereby causing frustration to clients and unequal competition between store locations.

So instead, the company used its own TV network and trained all the store technicians in a single two-hour program. Each store spent about $200 for the installation of the training equipment, and the ongoing cost of the satellite reception for each store was about $100 a month.

2. The use of simulators is another way that HTT is cost efficient. The experience of the J.H. Jansen Company, makers of recovery boilers for paper plants costing around $90 million each, shows the introduction of a complementary strategy as that used by Qantas. In response to rising insurance accident rates, the company developed an expert system, The Recovery Boiler Tutor (RBT), to train users of the boiler. The RBT, a hybrid between a simulator and a straight computer-based training (CBT) module allowed workers to make mistakes safely and at a relatively low cost. Insurance companies are now offering discounts to plants that use RBT for training.

Today many of the computer software companies are providing examples of their products on floppy disk. The use of self-paced computer-based training modules are now common place within the marketplace.

David Marshak predicts that the integration of new types of information presentation, particularly audio and video, into our day-to-day business activities is likely to happen, and when it does will greatly enhance our ability to receive, process and act on information. The combination of these technologies will allow the message to appeal to all the senses and thus the user will 'experience' the training as well as be exposed to the logic of the content.

The downside of the HTT issue

The picture presented thus far would suggest that High Technology Training methods should be on the agenda of every organisation's training strategy. However, before leaping in one needs to be cautioned on the negatives which currently exits.

1. Costs

High Technology Training methods offers flexibility to educators. The use of self-paced Computer-Based training modules, allows training to be targeted at a larger student population than could have been contemplated by other traditional methods. However, the costs can only be justified if many people are going to use the training, or simulators are the only realistic alternative, once issues of traditional training time and costs have been considered. The cost to develop the HTT modules should not be under-estimated, as these can be substantial.

2. How dynamic is the subject product

The criticism most often expressed of HTT is that the hardware and courseware have short lives. Technology is rapidly changing so is society's demands for products and services. The technical nature of the products and their rapid turnover, can be intimidating; it can be difficult to take the time to learn a new set of techniques and skills.

3. The lack of technological standards

The development and adoption of standards has always lagged behind the technologies development cycle. A comprehensive set of standards relating to the multimedia applications arena has yet to appear. The issues are complex and cannot be limited to a single market segment. For example, the ability to integrate the various media products form the consumer market, such as audio CD's, CD-ROM's, VCR's, video cameras into the more traditional computing applications being developed for the business applications market are essential if the potential of the multimedia applications approach is to be realised. The volume of data involved means that standards relating to the compression of audio and video is also required.

Not only do the individual products need to conform to data interchange standards but the multimedia support needs to also be integrated within the operating systems environment. The major computer companies are making inroads in this area, however proprietary solutions are resulting. Apple has demonstrated the integration of video into the Macintosh environment. Microsoft and IBM have announced that the next version s of Windows and OS/2 will have extensions to support multimedia.

As David Marshak comments, that 'getting the infrastructure to move multimedia objects around the network will be of little use, if the only system that can view a multimedia object is the one that created it.'

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The following is a list of tools that Intel considers necessary for a full multimedia development environment to be a reality:
Video editor; audio editor; graphics library; paint package; animator package; database; file conversion; clip art; general authoring; hypermedia authoring; business presentation product; I/O device drivers and networking.

Intel claims that while no system currently provides all of these, the one that can most quickly provide the whole set will become the development platform of choice.

Marshak reports that three companies, in particular are currently providing leading-edge multimedia tools on the Macintosh:

- MacroMind : animation and multimedia presentation;
- Farallon : voice annotation and multimedia authoring
- Avid : desktop video editing

Within the IBM PC environment:

- Owl : multimedia, hypermedia authoring system
- AutoDesk : animator and its thrust from CAD to Simulation
- Authorware : a CBT authoring system aimed at both the MAC and IBM

Both MacroMind and Farallon are developing versions for the IBM PC environment.

Conclusion

Technological development appears to be limited only by the extent of human imagination. The technical problems which exist today will be overcome in the future. The key to market success for organisations revolves around the ability to receive, process, interpret and act on information. As Marshak comments 'by putting information in its most appropriate form, be it image, voice or video, we are increasing the human "Bandwidth" available to receive it.'

Having quickly examined the issue of HTT, I'd like to take this opportunity to pose a few questions, hoping that David's answers will give a further insight in the issues relating to application of HTT methods within Qantas.

The use of HTT has many advantages, but should only be adopted if it passes a cost/benefit approach for a given training situation. Perhaps "David could comment on procedures which Qantas has adopted for monitoring costs and measuring benefits achieved by these programs.

The choice of an appropriate package which fulfils the requirements is also vital. The evaluation process will take time and effort, requiring the attention of personnel with appropriate skills in the content as well as the delivery methods. The question arises, what process does Qantas use to ensure that the packages represent quality training?

In the paper, David explains that students who do not achieve a 'pass' rating need to repeat the training session. The question arises, how is the pass rate determined, and is the result used to tailor the repeat sessions to the individuals areas of weakness as detected in the 'failed' training session.

The challenge for organisational training experts must be to ensure that the appropriate use of new technology is achieved, resulting in quality training being delivered. This will require skills development for both trainers and students alike. It is evident that the training division within Qantas is well advanced to meeting this challenge.

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INDUSTRY DAY
KEYNOTE ADDRESS
TWO

John Sayer
Associate Director
Queensland Distance Education College

John has been employed by TAFE Queensland for the past eleven (11) years. In addition to his present position with he Queensland Distance Education College (QDEC), he has had teaching experience at the Gateway and Gladstone Colleges of TAFE, and has held State Office positions of Curriculum Development Officer, Divisional Safety Officer and Senior Staffing Officer.

As the Associate Director (Studies) At QDEC John, is responsible for the day to day operation of the Department of Technology, Department of Rural and Applied Science, Department of Community Studies and the Open Learning Training Technology Centre.

One of John's major interests lies in the development and implementation of innovative delivery methodologies for use in a distance education application. This interest has led John to work very closely with the staff of the Open Learning Training Technology Centre in the development of a Computer Managed Learning System which has been primarily designed for distance education.

As a direct consequence of his interest in innovative delivery methodologies, John is working on several projects in which industry based training programs are being designed in accordance with open learning philosophy. In this way, a maximum of flexibility in how and when programs are undertaken and completed is provided for students.

John is also interested in the concept of harnessing the resources of a community to support the provision of vocational education and training programs. To this end, he is working with several enterprises, community groups and other government Departments with the aim of conducting a major pilot program of the concept in central Queensland in early 1991.

Mike Donaghue
Training Superintendent
Callide B Power Station

Mike Donaghue is currently employed as the Training Superintendent at Callide 'B' Power Station in Biloela, Central Queensland.

Mike has managed the development of the skills acquisition process using the philosophy of the material used being self paced, modularised and computer managed. He has also been involved in the development of all facets of the organisation at Callide.

Mike has has extensive experience in management and supervisory development with both the public and private sector.

AN OPEN LEARNING APPROACH
IN THE INDUSTRY TRAINING CONTEXT

John Sayer
Queensland Distance Education Centre
Mike Donaghue
Training Superintendent
Callide "B" Power Station

Introduction

The Training Model that has been developed by the Callide "B" Power Station and the Queensland Distance Education College has its origins in a potent mixture of self interest and institutional vision.

The Callide "B" Power Station needed more support from TAFE than it was able to obtain from traditional TAFE institutions.

The Queensland Distance Education College needed development and delivery methodologies that would enable it to develop and deliver competency based training materials for industries located at remote sites.

Both operations had expressed a vision for themselves as innovators in the field of quality industry training.

The initial contact was made between the two parties when training personnel from Callide "B" visited QDEC. The Callide people, were interested in the courseware that QDEC possessed and the role that material could play int heir own training program and the relationship they had with the Gladstone College of TAFE.

It soon became obvious to both parties that the traditional distance education materials that QDEC possessed were not really suitable for an industry application. The objective structure was not suitable, the content tended to be too verbose and the assessment requirements were too College centred. However, the main criticism that the Callide people had was that the courseware was course and subject based. What the Callide people really wanted was a menu of modules that they could select from to suit their own training program.

It would be useful at this stage to digress for a short time and gain an appreciation of the needs of the two players in this relationship.

Callide "B" Power Station

- Had its own Enterprise Based Industrial agreement.
- Consequently this enterprise based agreement recognised job descriptions and or skill groupings unlike that found elsewhere in the State.
- Their training needs were not only industry specific, but also 'Callide B' specific.
- The Callide philosophy recognises all of their staff as responsible adults capable of managing their own lives outside of the work environment, and are therefore asked to use these skills in the work environment.

Consequently the staff manage their own training program on a day to day basis, only calling upon identified mentors and training officers when a specified situation arises or when they themselves feel the need.

- As a result of this approach the delivery of training needed to be self paced, competency based, modular training packages.
- A Computer Managed Learning system was developed to also support the person moving through their training. This also has the added advantage of tracking the employee through their training plan and consequently creating an employee history file.
- There was a further need for the training materials to be available 24 hours a day and 365 days of a year with a set of flexible assessment procedures.

In summary the Callide "B" Power Station specified as its needs:

- Selection of training materials to be made from a Menu
- All materials to be self paced competency based and modular
- Access to training materials to be on a 24 hour, 365 day per year basis
- Assessment procedures to be criterion based, and flexible enough to allow procedures to be continuous, with provision for on and off the job assessment.

Queensland Distance Education College

- The Queensland Distance Education College had just undergone a major review.
- QDEC was adopting Open Learning philosophy as the core of its operation.
- Traditional assumptions were being challenged daily.
- The National Award restructuring process was starting to impact upon QDEC in that almost daily demands were being made upon QDEC to provide competency based training materials to industry.
- The Training Method Development project was instituted and was responsible for developing a prototype competency based development methodology specifically aimed at developing competency based training material for a distance education application.
- QDEC created:
    - The Distance Education Media Centre;
    - An Instructional Design team; and
    - An Industry Training Unit.
- The Instructional Design team and the Industry Training Unit were amalgamated to create the Open Learning Training Technologies Centre (OTEC).
- The main focus of OTEC is the applied research, development and implementation of innovative industry training programs. To this end OTEC has been involved in the development of :
    - An Electronic Lesson Guide Development tool
    - A QDEC specific Communications software package for use with Key Link
    - An Electronic Student management system

- The systems and necessary expertise for the Management of the Electronic Student Management system

- An Electronic Enrolment Package for use by Industry

- Innovative courseware focused upon the national Award Restructuring Process

QDEC, through OTEC, had a need to field test its software and courseware developments with an enterprise that would be sympathetic while providing the necessary constructive criticism necessary in the implementation and evaluation of its innovations.

The obvious partner for QDEC was the Callide "B" Power Station. We have been formally working together since November 1989. This working relationship is focused upon the development of courseware in the Electronics and Social Technology areas. This has also given OTEC the opportunity to field test its software developments and delivery strategies.

Concept Development

Very early in the concept development phase it was obvious what would have to be achieved. The National Award Restructuring debate and more particularly the training personnel from Callide "B" were indicating that training materials would have to be:

- Competency Based
- Modular
- Self Paced
- Developed in a minimal time frame
- Constantly reviewed for currency and relevance
- Flexible enough to allow for access by employee of students with a minimum of constraints

Given that it was clear as to what the focus was to be, QDEC and Callide "B" set about the task which we felt at the time was large, yet reasonably simple. We had only just started our "reasonably simple" task when we discovered the realities of our operational circumstance. While the National Award Restructuring debate had identified all of the issues to be addressed, there were however very few players in the field attempting to address these issues from an operational point of view.

Issues Concerned With Operationalizing the Project.

1. Competency Based Development Methodology.

QDEC initially was of the opinion that it would be a simple task to take its existing courseware and reconfigure it into competency based materials. It soon became apparent that the specifications necessary to produce these materials at the level QDEC was wanting to produce them was not available. More importantly to QDEC a development model appropriate to a distance education application could not be identified.

QDEC Staff were then given the task of becoming fully informed of the required operational outcomes of the National Award Restructuring process. Parallel to this, an appropriate development methodology for competency based training materials was developed.

In carrying out these tasks the QDEC Staff involved focused their attention upon the Award Restructuring process being undertaken by the Metal Industry, the Clothing

Footwear and Textiles Industry, the Mining Industry and enterprises such as BHP and the Callide "B" power station.

The outcomes of the process clearly identified the need for the development of an overall training system that would give any training program and consequently the required competency based training materials a context in which to exist. Thereby the specification of the necessary training materials would also become a relatively simple task.

Consequently QDEC has now developed a complete training system in which one small component is the development methodology necessary to develop competency based training modules for delivery at a distance.

Once again it cannot be emphasised too heavily that the process used to specify the training need is the crux of the whole matter. The success of the whole training program and consequently the usefulness of the training materials, is dependant upon this process. This also emphasises the fact that the use of any information technology in the training area will amount to little if there is a false premise used in the development of any Computer Based or Computer Managed Learning materials. There are already many expensive examples of this in Australia already.

2. Modular Training Materials

It was felt that it would be a relatively simple process to modularize the existing courseware that QDEC possessed. Once again the task grew before our very eyes.

Whenever entering into the development of modular competency based training material there are two very separate and distinct tasks confronting the process. One is modularising the material and the other is developing the material in a competency based format.

The whole process is complicated even further by the different meaning of the word 'module'. Modules at a national level are quite large representing in the average about forty hours of study. The modules employers are requesting to supplement their training program are quite small with clearly identifiable units of work, sometimes requiring only twenty minutes of study by an employee. From a resource development point of view a module is useful not only in the identification and storage of material in both the development and review process but also in the administration of training programs (student history files etc.).

The challenge then for QDEC was to find the most appropriate method and or system to adopt in the modularisation process. Several authoring packages were researched to ascertain their usefulness in this process. However given that three major enterprises that QDEC was working with each used different authoring packages, and our own department was entering into a licensing agreement to use yet another, it was decided to use a database for the development of learning materials.

This database has been in development for the past year and is now starting to be widely used throughout QDEC. The most important feature of this database is that modules now can be easily identified, retrieved, reviewed and stored.

This process also allows for a menu of developed modules to be easily created a feature that word processing cannot easily emulate.

The key to the use of the database, is the Electronic Lesson Guide Development Tool. This is the up-front planning and Instructional Design work that must be carried out before any work is entered into the computer.

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3. Self Paced Training Material

In a self paced program the student not only has to be able to work at their own pace but they must have access to the necessary resources and tutorial support when they require it.

QDEC was once again faced with a challenge. It was at this point that our need to provide resources and tutorial support to students was almost mirrored by industries' need to conduct structured training programs on site.

The marriage of these two needs has seen the creation of Open Learning Training Technology Centres. These centres are located within an enterprise and are the support infrastructure necessary for QDEC to conduct self paced programs.

QDEC is in contact with these Open Learning Training Technology Centre by telephone, fax and computer. The telephone and fax is used for direct student support activities while the computer is mainly used for data transfer.

The computer at QDEC is linked to the OTEC Centres via keylink and the data transfer is controlled through a communications software package developed by QDEC for this purpose. At this stage it is possible for QDEC to take electronic enrolments from OTEC centres and down-load lesson guides and up-load student history data.

Currently there are two OTEC centres in the state: one is at the Callide 'B' Power Station whilst the other one is at the Currugh Coal Mine. As previously mentioned these centres provide the necessary support infrastructure for QDEC to conduct self paced programs at a distance. This support is provided by a ready access by the student to telephones, Fax machine and computing facilities as well as a quiet area for the student to work.

There is also a need for a resource centre to provide the most important aspect of the process, and that is the timely access to tutorial support by the student. This is done by identifying an employee on site who has the appropriate skills and knowledge to fulfil the role of the tutor or to identify a resident in the local community who is appropriately qualified to fulfil this role. Regardless of the method used to provide the tutorial support, QDEC vets these tutors very thoroughly and determines their appropriateness for the task. The enterprise involved may nominate people for this role but have little or no part to play in QDEC's recognition of them. It is important that QDEC has control over the tutor used as they control the majority of the on site assessment with QDEC intervening at appropriate time to ensure the quality of assessment process is adequate.

4. Training Materials Developed in a Minimal Time Frame.

There are several factors that impact upon the timely development of training materials. The most important of these is the cost of development and the ready access to the people who are currently working in the area. The other important factor that has to be closely monitored is the duplication of effort that can quite easily occur.

QDEC has approached the timely development of training materials from several directions at the same time. Firstly, before any courseware is developed, an Australia wide search is made for suitable training materials that have already been developed. Consequently, a database of providers and available training materials is being developed.

Joint Industry/QDEC development projects are preferred as this provides the necessary currency and industry expertise in the content development, while QDEC provides the necessary instructional design and development expertise required for the project. This approach to the development of training material also dramatically reduces the development costs to both parties.

The development methodology that QDEC now has at its disposal has dramatically reduced the time taken to develop training materials. This, in the main, can be attributed to the use of the Electronic Lesson Guide Development Tool.

5. Training Materials Constantly Reviewed for Currency and Relevance.

QDEC believes as the growing body of training materials requires minor and major review for currency and development, close industry links will become of paramount importance. The main issues will once again be the cost and the access to the industry experts currently working in the field.

QDEC believes that once again its development methodology coupled with its database development will position it well for the review process.

6. Training Materials Accessed by Employees with the Minimum of Constraints

QDEC once again believes that, with the open learning approach to its operation, coupled with the proliferation of industry based Open Learning Training Technology Centres, employees should have easy access to appropriate training materials.

Regardless of the advances that QDEC is making in the delivery of training materials it has been very careful to ensure that an individual can still access its training material if they so desire. There is no compulsion on anybody's part to participate only through an OTEC centre. If there is not an OTEC centre available to an employee it will only slow down the speed at which they can work through the training program they are enrolled in. It will mean that QDEC will have to employ more traditional distance education methodologies in the provision of the appropriate resources and tutorial support to the employee/student.

Conclusion

In conclusion there are several points that have to be highlighted:

- The training function must exist within a context. Some may say that the National Award Restructuring Process provides this context for us. However the Award Restructuring Process is only identifying for us that there is a need for training and then goes on to define the preferred methodology for the development of those materials, that is they should be Competency Based. The Training Guarantee legislation takes this one step further and tells us that all approved training must now be structured.

- We all now know quite clearly what the task is. The question now is how do we address this task nationally in a manner that addresses all of the issues especially the portability and recognition of skills both across industries and nation wide?

- Our answer to this question is that there has to be a Preferred Training System accepted nationally. This training system does not have to be highly prescriptive however it should be substantial enough to provide the necessary context for the training effort in Australia to proceed in a logical and rational manner.

  There are two very separate roles to be played in this system, simply put they are:

  a) The Employers/Industry have to become very skilled at specifying their training needs;

  b) The vocational education and training providers have to become skilled in the

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provision of Industry based training programs that are if necessary supported by off-the-ob training programs.

- The role that information technology has to play in this training system must be totally supportive. It has to be wisely used as a tool in the development and provision of training programs. However, because of the lack of a nationally accepted training system what we are now seeing is Industry and Vocational Education and Training providers looking toward information technology for the solutions to the current problems facing them in the provision of training programs.

Seeking a solution in information technology is a very short sighted and limited approach to the training need in Australia. Somebody has to do the hard work of providing us with the context mentioned earlier. This work must focus upon organisational development as much as it needs to focus upon the delivery of training programs. Without this context the whole training effort in Australia will continue to be hall-marked by a largely unrelated and mismatched set of approaches to the development and delivery of training programs.

Given our experiences over the past two years we are now very optimistic as to what the future may bring in the training area. However major mind shifts are necessary and all of our current basic assumptions must be challenged.

RESPONSE

Open Learning Approach in the Industry Training Context

by

John Sayer and Mike Donaghue

Response by

Jeni Neary
Anderson Consulting

It is both refreshing and reassuring to learn that a joint venture between a tertiary training institution and an industry client is successful. Too often tertiary providers dominate such a relationship and impose academic expectations on the provision of training for the industry.

John Sayer and Mike Donahue's paper outlines the evolutionary process applied to developing an open learning approach in an industry training context. The paper is very honest in its acknowledgement that what was originally perceived as a very simple task, developing training materials to match a training approach, grew more complex and complicated as further research was pursued.

The authors hint at, but fail to emphasise, the criticality of applying sound instructional design practices and procedures in developing training. Indeed, I seriously question the statement that distance education applications could not be identified.

For the past two decades, systematic approaches to instructional design have been taught by the University of Florida and Wisconsin in Masters and PhD programs, and at a Masters level in Australia for at least 5 years at Deakin University. Professors Dick and Carey from Florida State have worked intensively with defense, government and private clients on refining ID methodologies to address training needs of personnel in local and remote sites.

Systematic Instructional Design addresses training needs through Job Task Analysis and needs assessment methods and develops design specifications on target audience characteristics, business goals of the organisation, training objectives for learners, appropriate instructional strategy criterion referenced testing, use of existing materials and content. Using this approach, methodologies have been developed by considerable numbers of training providers to address particular approaches such as competency based training and distance education.

I view with concern the assertion that the development methodology is one small component of the complete training system being used by the paper's authors. Professional instructional designers regard methodologies as the lynchpin of training management to design and provide all design, development and delivery specifications, products and procedures according to well research and tested principles.

I recognise that the authors believe that their database is a suitable delivery mechanism at present for their course materials. However, it would appear to serve an electronic page timing role rather than provide a high degree of interactivity and flexibility for the learner in using learning materials. Appropriately addressing the variety of learning style in target audiences through the provision of a variety of instructional approaches and media ensures mastery of learning. Indeed a self paced approach should not be the only way of implementing a competency, based training approach which relies on performance standards and competencies but does not dictate instructional strategies. The essence of effective instructional design is to match instructional strategy to learner objectives and enhance learning styles, and not to content.

The course objectives, expressed in competency terms and with standards attached should outline criterion reference test items to determine success or otherwise in competencies. If these criterion referenced test items are well designed, why then is there the need to use tutors to control the on-site assessment. If, as the paper asserts in the introduction on needs, the Callide philosophy recognises all of their staff as responsible adults, why then are the learners not permitted to take charge of the testing process for themselves.

I conclude with some comments on the paper's conclusion. I share the authors' concern for employers/industry to acquire the skills to specify training needs which relate to the business plans and goals of organisations. Job Task Analysis, Skills Audits, and Needs Assessment skills need to be taught to and shared among organisations. Requirements of the Training Guarantee legislation is forcing this learning issue.

However, I would dispute the notion of a Preferred Training System accepted nationally, for the needs of industry and commerce to address change, re-skilling and estimating will different from industry to industry and within individuals. It is crucial however that training providers servicing industry acquire and practice the instructional design skills to design and develop organisation-specific structured programs that directly address that organisation's training needs. 'Off-the-shelf' solutions to training only ever offer a band-aid approach.

I agree with the authors' assertion that viewing information technology as a solution to training problems is very short sighted and limited. Computers can be excellent instructional tools only if the instructional design of learning modules in CBT and IUD is sound, encourages interactivity and utilises the full functions of the authoring package.

The vision for the 'clever country' recognises that people are our most valuable resource. The success of our business and industry is directly related to the skills and expertise of our employees. The venture between QDEC and Callide B certainly points the way in operational terms.

INDUSTRY DAY

KEYNOTE ADDRESS

THREE

Neil Divett
The Surveyor General
Department of Lands

Dr Neil Divett was awarded a Bachelor of Surveying in 1957 and is a Licensed Surveyor. He has continued to further his education, attaining a Graduate Diploma of Town and Country Planning in 1969, a Masters of Urban Studies in 1976 and in 1988 he was awarded a PhD in Geographical Sciences from the University of Queensland.

A Fellow and Past President of the Institution of Surveyors, Australia (Qld Division), he is also a member of the Royal Australian Institute of Public Administration, member of the Queensland Surveying and Mapping Advisory Council, President of the Queensland Surveyors Board and Director of the Australian Key Centre in Land Information Studies.

Neil joined the Department of Lands - Information from the Australian Survey Office in 1982. He presently holds the position of Assistant Director-General (Information) and Surveyor-General where he is involved in industry and educational policy formulation and implementation.

IT AWARENESS - FROM THE BOARD LEVEL TO THE COALFACE

Dr Neil Divett
Surveyor-General of Queensland
Assistant Director-General, Information
Department of Lands
Peter Lennon
Research Officer
Applied Research
Division of Information
Department of Lands

Abstract

The paper addresses the issues involved in raising the computer literacy of a Department and in developing its awareness and use of Information Technology. The former Queensland Department of Geographic Information became a leader in the field of Information Technology. The policy issues involved in its transformation from a paper based organisation to an organisation with a high level of Information Technology use are discussed.

Since the Queensland election of December 1989, the Department of Lands has emerged which is an amalgamation of four Departments and includes the former Department of Geographic Information. The new State Government is in the process of establishing a broad vision of Information Technology management for the entire Queensland Public Service, which is now being driven from the highest levels.

The paper also discusses the Information Technology issues relating to this merger and the acceptance of the Government's broad vision of Information Technology as an essential tool, for use at all levels of an organisational hierarchy.

INTRODUCTION

The application of modern Information Technology (IT) is giving Governments and society access to information, the quality and quantity of which was not even imagined a short time ago.

IT will fundamentally alter organisational environments and social structures. Combined with deregulation and global competition, IT will eliminate many of the historical boundaries that formerly constrained organisations and nations. These are familiar lines to those of us who have been involved in the Information Technology area for any length of time.

There has been over many years, a growing dependence upon the use of computers and on IT, in nearly all organisations, but it is only in recent times that Governments in Australia have begun to identify the importance of the expanding tradeable information sector as an economic resource. Governments are beginning to regard their enormous reservoirs of information as commercially exploitable economic resources.

It has been recognised in the United Kingdom (Great Britain. Information Technology Advisory Panel, 1983) that provision of information is an increasingly important commercial activity largely unrecognised in economic statistics. There is now an expanding tradeable information sector - financial and business information, printing and publishing, on-line technical information, consultancies etc. Private and public sectors are beginning to pay much more attention to information as a commercial commodity, and are concerned with the creation and maintenance of its value.

In Australia, it is now a very contemporary issue that Governments are beginning to incorporate IT into their strategic planning processes, particularly since almost all of the business of Government is concerned with information processing.

The former Queensland Department of Geographic Information at an early stage recognised the importance of IT and the key role played by Government in collecting and distributing data. The Department began implementing a technology inspired vision in 1982 to take strategic advantage of its information holdings.

This paper deals broadly with that Department's experiences in grappling with IT, the implementation strategies that evolved and the education and training of management and staff.

After the State election of December 1989, the Department merged with three other existing State Government Departments to become the Department of Lands. Each of the former Departments had different kinds of information, different levels of incorporation, awareness and acceptance of IT, and different cultures. The situation has created a need for IT policy for the Department and for new education and training efforts both at the coalface and up to management levels.

The election also saw new vision coming down from the highest levels of Government. An Information Technology Review of the whole State Government was undertaken at the highest level with submission and subsequent approval of Review recommendations by State Cabinet. The Review represents a top down approach to IT management which will have profound effects at all levels of the State Public Sector and will require considerable education and training in IT from the board level to the coalface. Its recommendations require coordinated and deliberate IT management structures to be put in place within all Government Departments and the management of IT issues at the highest levels of each department.

IT DEVELOPMENT IN AN ORGANISATION - A case study.

The computer age dawned for business in the West in the 1950s, when a few firms acquired first- generation, vacuum-tube computers. The programming and operation of these machines were left to professionals, generally personnel who had previously worked with electronic accounting machinery and punched-card processing. Management and end users of computer systems had little contact with the specialists who were generally located in the data processing department. The 1960s witnessed widespread disappointment with computers. The promises of management information systems was never fulfilled. Neither managers nor systems designers knew what information a manager needed nor how to provide it through computers, except in a few rare cases.

Advances like database and on-line systems flourished in the 1970s, thereby bringing the users closer to computers. Users began working with computers directly whether or not they had any influence on the design of the systems. In the beginning, batch processing systems hid the inefficiencies of the computer from the users and buffered them from it. But the advent of on-line systems removed that buffer making the inefficiencies painfully obvious. As we entered the 1980s new delays in applications continued to discourage users. The computer services departments of many organisations were likely to encounter large time and cost overruns, often ultimately delivering a product that did not meet the original specifications. Information Technology has developed rapidly world-wide over the last five years.

The Queensland Department of Geographic Information was established in December 1975 to provide effective surveying and mapping services to the Queensland Government and to act as a catalyst for the development of the state's geographic information industry. The first encounters with the computer age in the Department of Geographic Information have followed the world-wide pattern quite closely. A few senior managers have been responsible for pioneering the development of IT for strategic advantage. They saw the opportunity for computerisation of some of the functions performed in the Department.

The most notable computerisation and the Department's first real step with operational IT was the development since November 1982, of the Digital Cadastral Data Base (DCDB) which is now nearing completion for the entire State. The DCDB commitment meant that information about cadastral boundaries was to be handled entirely in a computer system. In effect it was the beginnings of IT in the Department and an information revolution in which information about cadastral boundaries was input, manipulated and stored as a working data base for output from the computer system as data on floppy discs or tapes or as hardcopy through plotters. Mainframe computers were installed to accommodate this development and computer power was by definition centralised and in the hands of computer specialists. The implications of this step of IT were not realised by many in the beginning and it was looked at as computerisation rather than IT. This data base development has now placed the Department in a powerful information holding and trading position in Queensland.

Some managers however, did understand IT and recognised the possibilities of achieving enormous change. Change through IT's potential for having enormous strategic business impact, changing organisational functioning and improving business operations. They took keen interest in developments and saw the need for computerisation at the board level as well as in other functional areas at the coalface. Perhaps the first of the coalface contacts with computers, as has occurred in nearly every organisation, was the conversion of secretaries typewriters to wordprocessing computers attached to various printers.

The Department then began establishing a senior managers communications network operated through another mainframe computer, over which managers sent messages from their terminals concerning the day to day operations of the Department. Managers took to this network with interest as the novelty and gimmickry of the system encouraged its use. Later the efficiency of the system kept users involved particularly as important high level correspondence continued being communicated downward by senior managers. It was soon discovered that issues communicated across the network were dealt with within a half day. Issues dealt with in traditional ways took one to two days. Other major benefits were also realised such as the potential for individuals to continue operating out of hours knowing that they could still communicate without secretarial support to others still working. Messages to other executives sent out of hours would be read as soon as they logged on the next day. In effect the executives could still function out of hours without support.

Other utilities were added to the system such as; "media watch" which involved input into the system of scanned articles from newspapers dealing with issues of interest to people in the Department and a brainstorming utility with which an issue could be brainstormed by all users of the network. This network eventually developed into a department-wide PC based local area network with increasing numbers of staff interconnected. In the long term nearly all staff were to be connected including those in regional centres via a wide area network.

Being a decentralised department with offices in several regional centres throughout the State, an efficient long distance telecommunications system called Q-Net was utilised by connecting the regions via satellite telephone linkages. This system enabled regional offices to connect into the Department's Local Area Network and to access computer data bases.

Taking further advantage of IT to improve their own business operations, senior management approved and developed a management information system and a document tracking system as well as an executive information system containing Departmental statistics.

Other world-wide IT developments were accepted wholeheartedly as well. Developments such as the facsimile, geographic information systems (GIS), land information systems (LIS) and remote sensing are other examples of the Department's later efforts in IT. Other mapping functions, survey control data, and other paper records have now been computerised and will be connected for access via networking.

By 1988 the number of PCs in the Department had increased significantly and computer literate staff had also increased dramatically. Many staff had enrolled in extra studies and were encouraged and assisted by the Department both financially and in leave to attend lectures for approved courses. Computer oriented courses were particularly favoured with staff obtaining qualifications in computer science and in fields with strong computer usage such as remote sensing and geographic information systems. As elsewhere, many employees educated themselves in computer use as their personal interests in computers developed. Training for the construction of databases such as the DCDB was undertaken almost entirely in-house. In the office all employees were encouraged to use the computer systems of the Department daily, both for communications and for word processing and document formulation. The communications linkages have effectively flattened the organisation's hierarchical structure as staff at the coal face are able to communicate directly to the senior management and vice versa through the electronic communications offered in the network.

The development of the DCDB is still the Department's most significant functional involvement in IT causing considerable operational change at that level. Change at the senior levels has been wholeheartedly accepted. IT here is evidenced by the existence of networked PCs on every manager's desk. The advancement of IT in this organisation is not unique. Many other organisations have been transforming in similar ways as IT becomes more widespread. Until the Department's merger with three other Government Departments, IT involvement has been an evolutionary process rather than a deliberate Departmental policy. From the experience of this organisation's development as described, some conclusions can be drawn.

To initiate the evolution of an organisation to IT acceptance, it is easy to start at the top levels of the organisation's hierarchy as was done in this Department. This involved the raising of executive management's awareness and understanding of how important IT is for the business. Managers were at first exposed to and encouraged to exploit basic IT to improve their own efficiency. Other employees were then encouraged by senior managers to accept and to use IT communications linkages with management. This top down approach to implementation of IT through communications has demonstrated success in this instance. The exploitation of IT will mean that substantial management, organisational and business change will occur. Managers must realise that to exploit IT fully, they need to be aware of the potential of IT for achieving strategic business impact, changing organisational functioning and improving business operations. Such changes will be necessary not only to improve internal efficiencies and to cope with the enormous amount of information becoming available, but as other organisations take up IT for their day to day operations the interaction between organisations will require sufficient IT mechanisms.

In general, the former Department of Geographic Information practised an evolving policy of staff development where management and staff were encouraged to attend suitable usually in-service short courses relating to computers and their use when available and as new systems were established. The new Department of Lands has unequal levels of computer literacy. This can be easily exampled by the fact that by October 1990, within the new Department, in the Division of Information (formerly Department of Geographic Information), there were only approximately two employees to every computer. Elsewhere in the new Department that figure has been measured at approximately 4.4 employees per computer. The amalgamation of the former Queensland

Department of Geographic Information with others has heightened the need for IT mechanisms, particularly as IT can be used to assist in the amalgamation.

ORGANISATION AMALGAMATION

After the Queensland State election of 2nd December 1989, the new Government undertook to rationalise the State Public Sector. Part of this rationalisation was the reduction of 27 Government Departments to 18. Consequently the new Department of Lands emerged from amalgamation of the former:

.Department of Lands,
.Department of Geographic Information,
.Valuer-General's Department, and
.Department of Freehold Land Titles.

The former independent nature of the four departments led to the development of IT to different levels resulting in a diverse collection of equipment, standards, staff skills and expertise at all levels of the new Department from board level to coalface. Managers and staff in some areas have grasped the IT future wholeheartedly and in others not at all.

This diverse situation led, early in the merger, to the identification of the need for an Information Policy for the new Department. Since then the Lands Department has been grappling with three concepts:

.information as an economic resource,
.information technology as a strategic management tool, and
.information technology to assist and expedite the amalgamation.

The Department has identified the level of revenue being generated by the sale of Government information in Queensland at something in excess of $15 million each year. It is considered that there is opportunity to expand the usage of public sector information in the interests of improving economic performance and incidentally to increase Government revenue. This could be realised through further product development, value-adding and the development of additional categories of information.

After the amalgamation, plans were put in place for the full integration of many of the service areas of the Department into single units. For example there would of course only be one personnel unit, one marketing unit and one financial resources branch to avoid unnecessary duplications.

Other more significant plans were developed for the integration of functions or at least for the capacity to integrate the information output from those functions through IT. The former Departments, all being holders of valuable land related information such as land titles, land valuations, mapping and surveying were rationally amalgamated by the new Government, largely because of their land information relationships. It made sense then to computerise and integrate the information holdings and to be able to provide this related information about land in a value added format to provide better service both to the Government and to the public. A fully integrated system of land information, for example, would be of substantial benefit to those sectors involved in conveyancing, real estate and property development and would bring in increased revenue.

The development of a Departmental Information Policy was the next step toward formulating cohesive information planning involving issues such as data standards, consistency, accuracy, access, cost; and for the coordination of the mechanisms for establishment of the information network that would be required to integrate the Department's information holdings. Other IT developments in scanning technology, communications and other technical solutions would also need to be identified and researched. The relationship of the various types of land information now 'under the one

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roof makes the Department a key element in any Information System. The increase in information held by this new department may be four-fold but the value addedness of the new department's information could well be ten-fold. Land information is now recognised as an economic resource for the Department and IT is recognised as the management tool by which this resource is becoming value added and readily available for exploitation.

The development of a Departmental Information Policy will enable uniform information management across the Department and will result in the capacity to integrate consistent information when required to make and support land-related decisions. The development of the policy has not been completed to date. However, since the merger, an Information Strategic Plan has been developed which has established guiding principles, within which the Department can operate. The plan identifies the issues involved, the operational actions and the technology required, toward establishing a fully integrated land information system of all of the Department's information holdings. This plan seeks to use IT for strategic and economic advantage as well as to assist in the amalgamation. Networking and integrating IT will assist the amalgamation by electronically linking the new Department as one.

Senior managers in the Department are very much aware of the need for management control of IT, rather than leaving it to the technical specialists. Lucas (1986) states that:

> "in the past, too many managers have allowed the technology to drive decisions, rather than actively managing the technology themselves".

IT should be managed by senior managers who are aware of and responsible for achievement of the goals and objectives of the organisation. Leaving IT to technical specialists to manage can be a dangerous policy for several reasons. The implementation of information technology goes hand in hand with major organisational change. The establishment of future forms of organisation structure and the management of the change process are the normal business of senior management. This process should be carefully managed to avoid organisational impact that may have deleterious consequences on the effectiveness of the organisation and may limit the opportunities senior managers have to manage the enterprise. IT brings together data processing, text processing, and telecommunications. Information is the lifeblood of the organisation and as such is of major concern. It is imperative that it be planned and managed at the highest level.

GOVERNMENT-WIDE STRATEGIC INFORMATION PLAN

Independent of developments within the new Department, the new Government in Queensland has been active in IT, beginning almost immediately upon entering office, to undertake an IT Review of the whole Queensland Government. The purpose of the Review was to address a broad range of concerns over the Government's use of IT. The Review was given the task of recommending action plans for policy, coordination, management and rationalisation of the use of IT within the Government, and utilising IT's potential to assist the economic development of the State. The Review, released in September 1990, made in all 67 recommendations all approved by Cabinet, ranging from information standards and information architecture to monitoring and review and the establishment of an Information Policy Board. One of the many responsibilities of the Information Policy Board is to produce and regularly update a Government- wide Strategic Information Plan.

In emphasising the importance of IT the Review recommended that all Government agencies should establish Information Steering Committees chaired at the highest levels by either the Chief Executive Officer of the agency or his deputy and with Information Policy Board representation. Other membership should be a cross-section of other senior interested parties in the organisation. The Information Steering Committee of the organisation has the responsibility to coordinate the overall information resource of the organisation.

In relation to the theme of this conference, the review has recognised the need for education and training by stating that:

> "The people who work with information and their attitude to information management and technology will be crucial. Motivation and training in information skills, and the development of an information culture are needed at all levels but particularly amongst the Senior Executive. An intermediate education programme for Senior Executives and other officers responsible for information management should be initiated, so that planning processes can be undertaken successfully. This programme should be followed by an ongoing series of workshops and seminars".

In short the Review recommends ongoing training and education of staff (senior managers in particular) in IT. The Review also represents once again, a top down approach to implementation, planning and management of IT. Top down direction from the Information Policy Board to the Information Steering Committees and thence to the coalface.

CONCLUDING REMARKS

The gradual acceptance and development of Information Technology within a Government Department has been described. The advantages of using IT to assist the integration of organisations and the top down approach of the new Queensland Government to enforcing education, training and understanding of the importance of IT has been discussed.

IT is a very flexible technology which renders obsolete or changes many of the structures and functions of organisations. As the use of computers and IT continues to increase so will the need for training and education in these fields, not just for senior managers. Looking to the future Eason (1988) states:

> "the one feature of the future about which we can be reasonably certain is that rapid change will always be with us. The successful organisation willtherefore have to be an adaptive organisation. It must also have an ability to exploit the information technology it possesses and an ability to keep present forms of organisation under constant review".

This means ongoing education and training in IT of both senior executives and staff. MacDonald and Guruprasad (1986), argue that Government needs for training and education in IT go beyond the education of senior managers, although this is a vital starting point for the substantial cross-the-board program that is required. Education is important in fostering IT awareness, in understanding the changes necessary, in facilitating acceptance of change, and in implementing the change effectively. Both skills and knowledge bases will need updating because IT brings new possibilities, solutions and mechanisms to the organisation. Skills in the delivery and packaging of information will be essential, as organisations realise opportunities for value-adding of the information they hold. Other skills will be required to recognise these value adding opportunities.

Most authors in the IT field including the Queensland Government's IT Review team, recommend that IT should be a major item on the agenda of senior management and should not be left to the technical specialists on the principle that it is a technical matter. This ensures that the application objectives of IT relate to the goals of the organisation.

In summary, organisational structures in Australia are undergoing a period of rapid change based on Information Technology. Productivity improvements will be remarkable. As Strassman (1980) states, IT should be seen as a restructuring of the thinking and working methods of professionals, managers and administrators. IT will create a social environment in which information flows are managed in a conscious and explicit way. This then requires that we educate our senior managers to plan for IT, to take full advantage of IT and to be aware of the potential for value added products from IT. IT could well provide the economic stimulus that Australia now needs to remain competitive.

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RESPONSE

87

IT Awareness-from the Board level to the Coalface

by
Neil Divett

Response by
Ken Lyons
and Pramod Sharma
Department Geographic Sciences
The University of Queensland

Some Non-Technology Aspects of the Design and Implementation of Geographic Information Systems

This paper advances some propositions with respect tot he strategic direction and design, considers some issues arising from these, and discusses the implications for the successful design and implementation of geographic information systems.

Introduction

Decision making can be broken down into step:

- Knowing about, and having access to, the relevant data, in a timely manner.
- Integrating the different data, analysing the composite information, drawing conclusions and making predictions.
- Making decisions based on the above.

It is, therefore, not surprising that there is general agreement that accurate, timely and accessible data is a minimum requirement for proper decision making as well as providing the basis for conflict resolution.

In general the required data exist but few are aware of this face, let alone know how to access, integrate and use, to assist in decision making. Over the past decade perhaps the most significant tool which has emerged to carry out these tasks is the geographic information system (GIS)[1]. These GISs can be regarded as the core elements of the information infrastructure of a country.

Some Propositions

The following are put forward as propositions and factors of a non-technical nature which need to be taken into account in the strategic design of Geographic Information Systems:

1. That planning and management in a country would be significantly enhanced by the establishment of geographic information systems which contain a large amount of geographically referenced data. These data represent the heart of the GIS.

2. The primary purpose of these systems would be to assist decision making.

---

[1] (Note: In this paper the terms, Geographic Information System (GIS), Spatial Information System (SIS), Land Information Systems (LIS) and Spatial Information Systems (RIS) are all used interchangeably as are the terms 'spatial', 'geographic' and 'land' data - this is not to ignore the real differences among them when they are used *sensu stricto*).

3. That the decision making would be in direct support of each organisation's mission and the corporate needs of a number of organisations who have a charter to, or interest in planning or geographic analyses.

4. That about 80% of decisions taken at a local level of government require some form of land related data; that approximately 60% of the data is probably collected by that level of government itself with the remainder coming from a large number of other government organisations.

5. That large and significant amounts of data are held by governments and agencies at various levels (national, provincial/state and local) and that significant duplication and inconsistency of data exists; however, there is no shortage *per se* of existing data.

6. That to assist decision making access to several layers/types/classes of data is necessary and that significant benefits from GIS do not flow until these layers of data are in digital form, reliable and integrated over a common geographic area.

7. There is a lack of knowledge on what data is 'essential' or 'highly desirable' or 'nice' to support various types of decisions and there are many unknowns with respect to data reliability, quality, availability and how data might be integrated.

8. Conversion of data from paper to digital form, updating the currency of records, and upgrading the reliability of records is a major (40-70%) part of the total project cost and usually take many years to accomplish.

9. That GIS is not simply a black box nor a turn-key technology with 'magic' properties; but rather that the 'S' in GIS stands for a 'system', which has major components of **organisations, data, technology and people.**

10. That, in general, development to date has been more technology driven rather than user pull, particularly from the point of view of improved decision making (although this is an often heard criticism of information systems in general).

11. That in many implemented systems achieving success is proving much more difficult than originally envisaged and that the reasons are mainly organisational and management related (80% percent?)

12. That the major test of a system should be that after a period of time (seven years?) it is still surviving and being used as a normal working tool, on a regular basis, by a large variety to assist their routine decision making.

13. That is a GIS is implemented, in one part of an organisation to support that section of the organisation's work then the cost-benefit ratio is probably 1:2. If systems are put in place to benefit several groups in the organisation then the cost-benefit ratio is 1:4.

If corporate systems are installed to be an intrinsic part of the organisation then the cost-benefit ratio is likely to 1:8 or 1:10; and if in a country organisations can align their separate charters and needs to support each other (as well as many other users) then the cost:benefit ratio can be expected to increase significantly.

Some Issues Arising

The following issues can be considered to arise from the previous propositions.

1. If the driving force is to be decision making then an analysis needs to be made of the following: what decision are required together with a grading of importance of these decisions into categories such as, ';very important', 'important', '

nice' etc. and for there to be a general consensus amongst the users of the system that these ratings are correct.

2. The range of questions that need to be posed to assist in making the decisions need to be determined, and agreed upon.

3. Having determined the decisions and the questions, then an analysis needs to be done of the data types, data classes, etc. that need to be available and accessed to enable the questions to be answered.

4. Having determined the data (together with a rating of, 'very important', 'important' or 'nice' necessary to support the various classification of decisions, then further analysis can be done of each of the data classes to determine aspects such as; does the data exist?, the quality of the data, the reliability of the data, who is the custodian? Where is it held? Can it be made available?, under what conditions?, What are the primary and secondary access keys??etc.etc.

From this the possibility of using the data to answer those questions can be determined; the effort required convert the data into digital form or make it available can be calculated; and the costs and effort can be examined in the light of benefits from making the decision.

Other issues that can be examined are alternate data sets which are readily available and reliable which might provide a slightly less reliable answer, but in terms of cost benefit trade-offs make economic sense. Also, other groupings of the data can be examined to see if other questions can also be answered by combining the data sets in different groupings.

5. Knowing the primary and secondary access keys, a study can be initiated to determine if and how the different data can be integrated; this will have implications in an organisational sense for data standards and perhaps the nature and the format of the data has to be changed so that it can be used by several different organisations; data conversion efforts by several agencies over defined geographical areas may need to be co-ordinated so that the benefits can flow due to integrated data sets being made available.

6. That since many decisions can probably only be made by grouping data that belong to a large number of organisations, who generally have a charter to pursue their own needs, then there needs to be some form of corporate agreement amongst key organisations concerning common needs, common priorities and hence common action plans with respect to data collection, data standards, data integration, data exchange etc.

7. That from a study of decisions to be supported, questions to be asked and data required, a further analysis of data can be carried out to determine, if there is a small core of data that is used by the majority of the users. This core should be converted into digital format, updated in currency and in reliability, and data redundancy removed as a matter of urgency, as only through integration will the system allow benefits to flow at an early stage to each of the organisations involved and to external users.

8. That because of the improvement in the cost to benefit ratio as system become more corporately based within a single organisation, and between organisations there needs to be active co-operation between key agencies. This in turn calls for more complex planning and longer time frames; an element of the design should be that it allows' thinking-big' but 'starting small' so that benefits flow on a regular sustained basis throughout the life of the whole project and that 'success' can be seen to be achieved.

9. That if one accept that these systems should be drive n from the point of view of decision making, then data becomes the core, as data has a life of up to several decades

while software has a life of five to seven years the hardware technology will have a life of two to five years and (life being defined as the time until something 'better' will appear on the market).

10. That in general the implementation of this technology will effect a change on the organisation. As such the aspects of organisational change should be recognised, identified very early in the planning phase, and a separate part of the project implementation should deal with preparing the organisation (both in a training way and in an organisational way) to accept whole-heartedly the changes that will occur. This is considered much more advantageous than simply implementing the technology and later having the organisation re-act and adapt in an *ad hoc* way to the changes as they become apparent - usually with some urgency.

11. That the challenge is to make the technology an integral part of the organisation and for it to be come used routinely in an operational sense.

12. There is evidence starting to emerge in many developed countries that for GIS systems achieving 'success' is much more difficult than at first thought. (This appears particularly to be the case with those GISs which integrate data from a large number of organisations to carry out land administration.) In most cases what constitutes 'success' or 'failure' is not clearly established in the initial phases of the project.

13. In many non-western countries the situation is more complex with regard to the lack of infrastructure, experience and support for the technology and the knowledge base as a whole; the data may not exist or be spread over many organisations who have strong views as to the charter of their own organisation.

Conclusions

This paper's major propositions are that geographic information systems would be an important part of the information infrastructure of a country and that the major purpose of these systems would be to assist decision making. Other propositions re also advanced.

If one accepts these, then certain issues arise which need addressing at a very early stage of system planning process. Failure to address and to build in as activities in the planning process could make 'success' difficult to achieve. If the system is designed from 'technology push' and these issues are ignored then 'success' could be difficult to achieve.

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TERTIARY DAY
KEYNOTE ADDRESS
ONE

Rod Sims
Executive
Australian Society for Computers in Learning in Tertiary Education (ASCILITE)

Rod Sims is a lecturer in the Faculty of Education at the university of Technology, Sydney with degrees in both Psychology and Education. Rod has worked in the computing and education field for over 15 years, specialising in the design, development and implementation of computer-based systems. With a background in commercial system design and training in computer applications, Rod has combined these fields to develop his main are of expertise in Computer-Based Training, where he provides consultative support in developing corporate strategies for the implementation of instructional technology. Apart from extensive experience in all facets of the design and development of instructional resources, Rod has also written widely on Computer-Based Training issues. His current research interests are directed towards the learner-computer interface and effective presentation styles for Computer-Based Training.

TECHNOLOGY AND TERTIARY EDUCATION: PARADIGM SHIFT OR TECHNOPHOBIA?

Rod Sims
Faculty of Education
University of Technology, Sydney

Abstract

There is no doubt that technology is one of the major issues in the education and training sectors. However, what is not clear is the actual function of the technology and the role which should be played by teaching staff in providing technology-based instruction. This presentation considers the various options for the implementation of technology within educational environments, focusing on the significance of and extent to which the instructional paradigm has altered as a result of technological innovation. Through a series of examples and discussion, the status of technology for training and education is evaluated. It is predicted that selected educational factors will have significant influence on the future of technology in education and training.

Introduction

Since the automation of various administrative functions using large and complex mainframe systems, technology in the training and educational sectors has taken on new meanings. In practically every business and faculty, technology courses are now being introduced to prepare students and staff for anticipated on-the-job performance requirements using an array of technology including personal computers, networks, software applications and productivity tools. At the same time, the often predicted benefits of using technology as a teaching tool are close to being realised, through the growing number of instructional software applications developed by mature instructional technologists and the skills being provided through the demand for training in instructional technology.

However, there is a conflict between the demand for educational excellence and the phenomena of technological innovation. On the one hand, teachers and employers alike insist upon excellence from their students or employees, and develop instructional strategies to achieve desired performance. With technology training, the basis of instruction typically involves hardware operational skills and effective use of software applications. Too often however, the required skills can be disrupted by the rapid developments in technology: while educators and trainers attempt to develop courses to satisfy installed technology, the technological market demands (or at least advertises) the need for skills in the latest technologies. With this tenuous framework, it is possible to compare the nature of actual or potential paradigm shifts in educational practice resulting from technology and technological developments with the problems associated with rapid technological growth. This paper addresses this situation by examining the extent to which technology is changing the way instruction is delivered (the paradigm shift) in comparison to the problems associated with constant developments in instructional technology (technophobia).

Instructional Technology Options

To analyse these factors, it is important to define the means by which technology can be integrated into the educational and teaching process. Essentially, there are three options available:

- Teaching using technology

  Where technology becomes the **equipment** of instruction and teaching. For example, using CAD/CAM technology.

- Teaching about technology

  Where technology is the **object** of instruction. For example, in computer literacy and awareness courses.

- Teaching with technology

  Where technology is an **instrument** of instruction and learning. For example, Computer-Assisted Learning provides instructional content.

As shown in Figure 1, these three factors are inexorably linked and, in many instances, one will not exist without at least one of the other two. For example, a word-processing class may use Computer-Assisted Learning to teach some basic operations (the instrument), the students may be taught basic computer operations (the object) and as word-processing is computer-based, technology is required for the teaching process (the equipment).

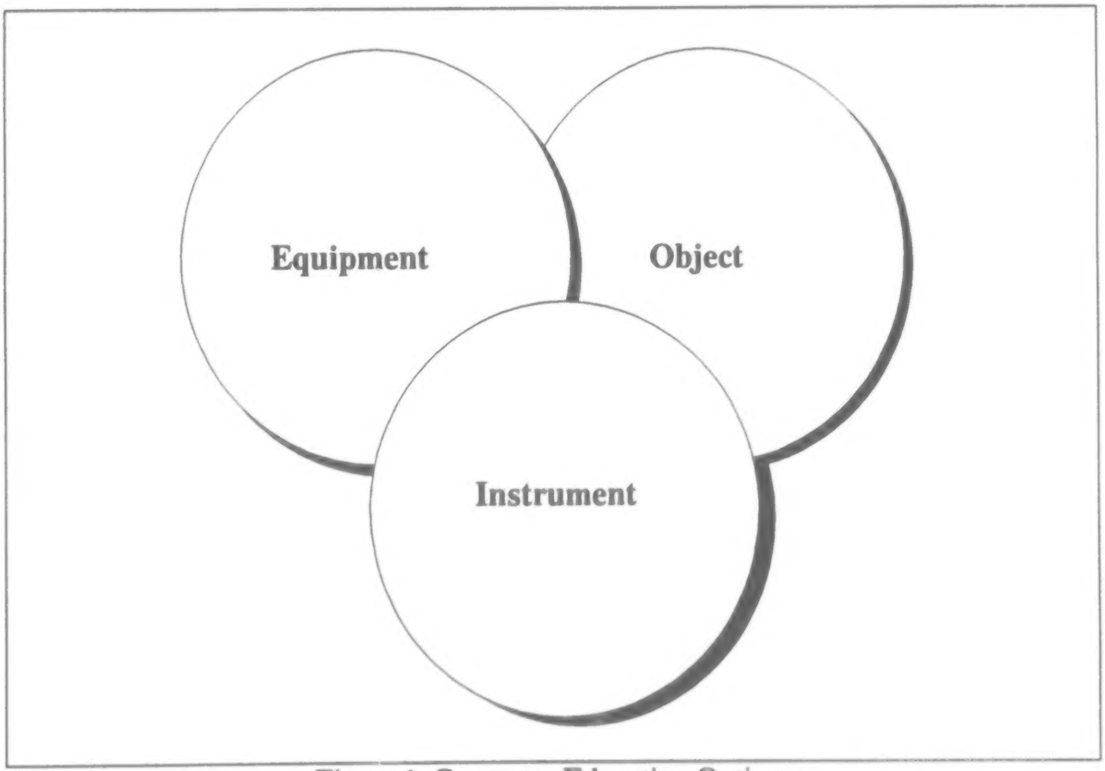


Figure 1: Computer Education Options

While there remains a significant interest in the way technology can be used within education and training (Sims, 1990a), the following elements of technology in education demonstrate the extent to which technology has become a major influence in instructional environments. For the purposes of this paper, the focus will be on technology as an instrument of learning and its effect on the means by which courses may be taught and instruction delivered. In doing this, the potential to address changes in instructional practice through technology compared to the risks of implementing technology-led instruction can be assessed.

Computer Education

The desire to teach students the fundamentals of technology is now almost universal, with almost all courses, irrespective of discipline, establishing introductory computing courses. The problem however, is that there is too often too little planning about the actual content required by students. For example, some of the TAFE colleges in NSW are introducing Desktop Publishing (DTP) courses because it is felt that there is an increasing demand for such skills. However, what has been neglected is the actual job analysis. For example, whether the student population will actually be formatting and designing documents or simply editing the text components. Even if the former situation is true, where students will design and produce documents, will the syllabus incorporate additional skills, traditionally specialist roles, such as graphics and page-layout? Based on recent discussions on implementing such programs into TAFE (Sims, 1990b), it was apparent that technology was too often the determinant of course development rather than a solution to an identified instructional need. This also reflects the industry situation where the purchase of appropriate software and hardware is often considered the only pre-requisite to effective use of an application. For example, assuming that access to a DTP system will result in better publications.

Computer education is vital, but only in terms of clearly identified instructional needs; the mere existence of technology is not reason enough to develop a course or implement software.

Computer-Managed Learning

One of the interesting phenomena of modern tertiary institutions is the total lack of automated management systems, despite their availability for the past 15 years. While NSW TAFE is testing a large Computer-Managed Learning (CML) application, it is apparent that very few teaching staff actually use the technology to simplify the regular administrative tasks of presenting tests, marking tests, collating results and helping with remediation activities.

CML does provide an option for changing the way courses are designed and delivered. Lecturers and trainers can use this component of the technology to minimise the time required to complete tasks such as marking and grading. For example, in many universities the grades are entered onto a grade sheet which is then entered into the computer. Why don't institutions simply provide a data entry screen for staff to directly enter grades? Technology has the potential to streamline many administrative procedures; it is interesting that the academic community maintains manual operations when comprehensive automated options are available.

Instructional Design

With the increasing use and interest in technology, developers of instructional software materials have placed significant emphasis on the methodologies of instructional design. While these closely parallel the processes of curriculum development, there is frequently too little time to devote to formal instructional design for new courses. And when new courses are developed, the focus tends to be on the content rather than the learners. It is anticipated that Instructional Systems Design methodologies will become more important in course development, and the paradigm shift will become most evident in the move from those focusing on the content (which should be delivered and learned) to the learner, and how they can best develop the skills to actively participate in a technology-based society.

Therefore, instructional design will grow as a process in the tertiary education and business sectors as a result of the demand for courses which are relevant to the needs of individual students. This will be amplified by the levying of course costs for higher education and the legislation for organisations to guarantee training.

Credentials

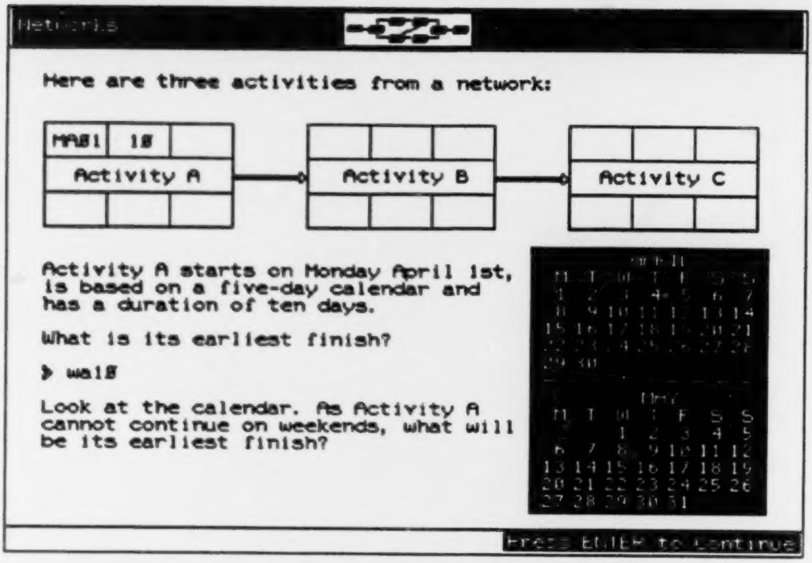
Given that instructional design and technology-based training will remain in demand, a more recent issue is the consideration of teaching the skills necessary to develop and manage computer-based education applications. Thus there is a growth in the development of courses which focus on instructional design and which provide skills encompassing disciplines such as Instructional Systems Development, Learning Styles, Screen Design, Human-Computer Interface, Graphics, Software Engineering, Project Management and Hardware Implementation.

Technology has, in many ways, forced the need for credentials in course design. However, the basics of instructional design and curriculum management must be maintained to ensure educational validity and reliability.

Computer-Assisted Learning

The application of the computer as an instrument of learning requires considerable insight and effort. As more and more institutions and organisations focus on economic factors of education, Computer-Assisted Learning (CAL) will play an increasingly major role in the delivery of educational content. For example, one Australian university has provided funding to investigate options for "reducing teaching time but not content", with CAL perceived as one of the major delivery mechanisms for achieving that goal.

Another issue with CAL is that it has traditionally been perceived as a method by which instruction can be delivered (Alessi & Trollip, 1985). The consequences of this have been the implementation of didactic instructional packages, where the instructional software (courseware) has acted as a surrogate teacher. Typical examples of this are shown in Figures 2(a) and 2(b), extracted from courseware modules for project management. However, it is also important to note that CAL is still criticised for poor-quality and excessive development time (Sims, 1990b). Therefore it is necessary to focus on whether the courseware will become effective when it is better designed or whether the fundamental assumptions on using the technology for instructional delivery are valid. Based on many years of observation, the author believes that CAL has proved ineffective because the medium has not been use correctly, rather than being a function of poor design.



Here are three activities from a network:

Activity A starts on Monday April 1st, is based on a five-day calendar and has a duration of ten days.

What is its earliest finish?

> wa10

Look at the calendar. As Activity A cannot continue on weekends, what will be its earliest finish?

Figure 2: Sample CAL Interaction

Summary

With the above elements of educational technology, it has been demonstrated that many have are will contribute to a change in the way education is structured and delivered. The importance of this lies in the assessment that technology is now an integral part of our environment, and that job performance will be dependant on an individual's capability to work with technology.

The following discussion examines the nature of the proposed paradigm shift in some detail and considers the problems associated with *technophobia*.

The Paradigm Shift

Much of past, present (and presumably future) education has been based on the instructor's perception of the content and discipline. The traditional lecture and tutorial have provided the framework for the teacher to emphasise their particular bias on the particular unit of instruction. But what of the student? What opportunities are there for learning, exploration and discovery? An illustration of the traditional approach is shown in Figure 3, where the student is guided through a content domain using a tutorial model of computer-based instruction. However, Figure 4 details an alternate approach whereby the student has greater flexibility in selecting options and being guided through instructional resources.

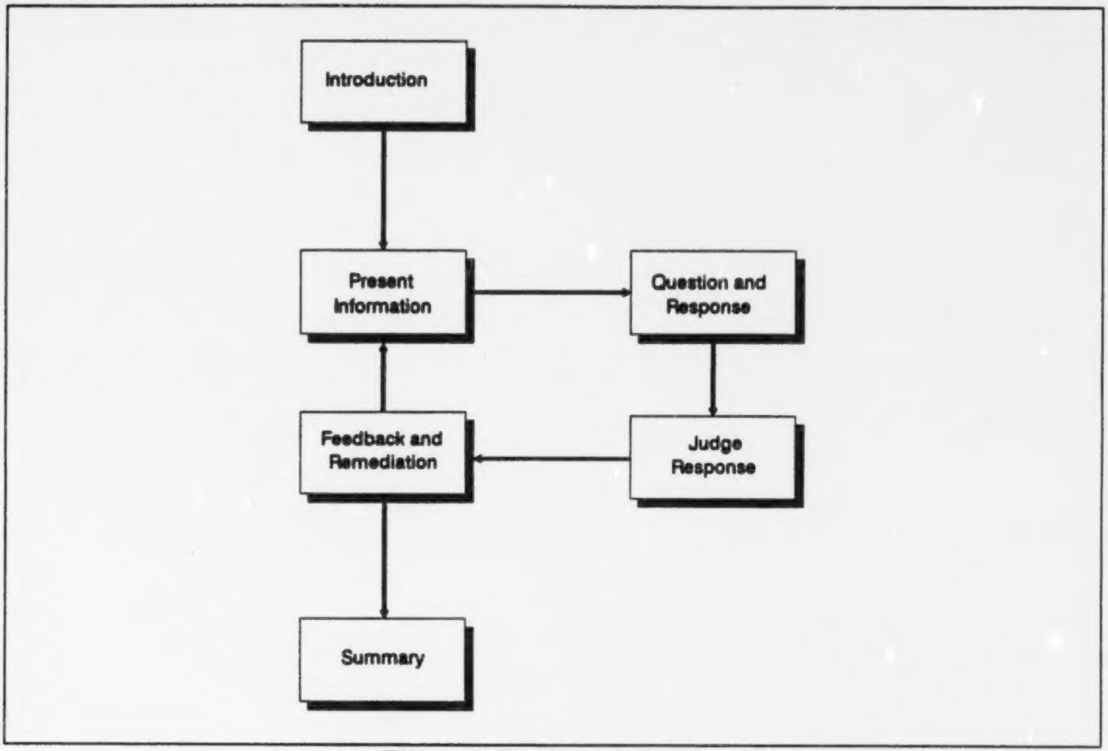

Introduction
Present Information
Question and Response
Judge Response
Feedback and Remediation
Summary

Figure 3: Traditional Design

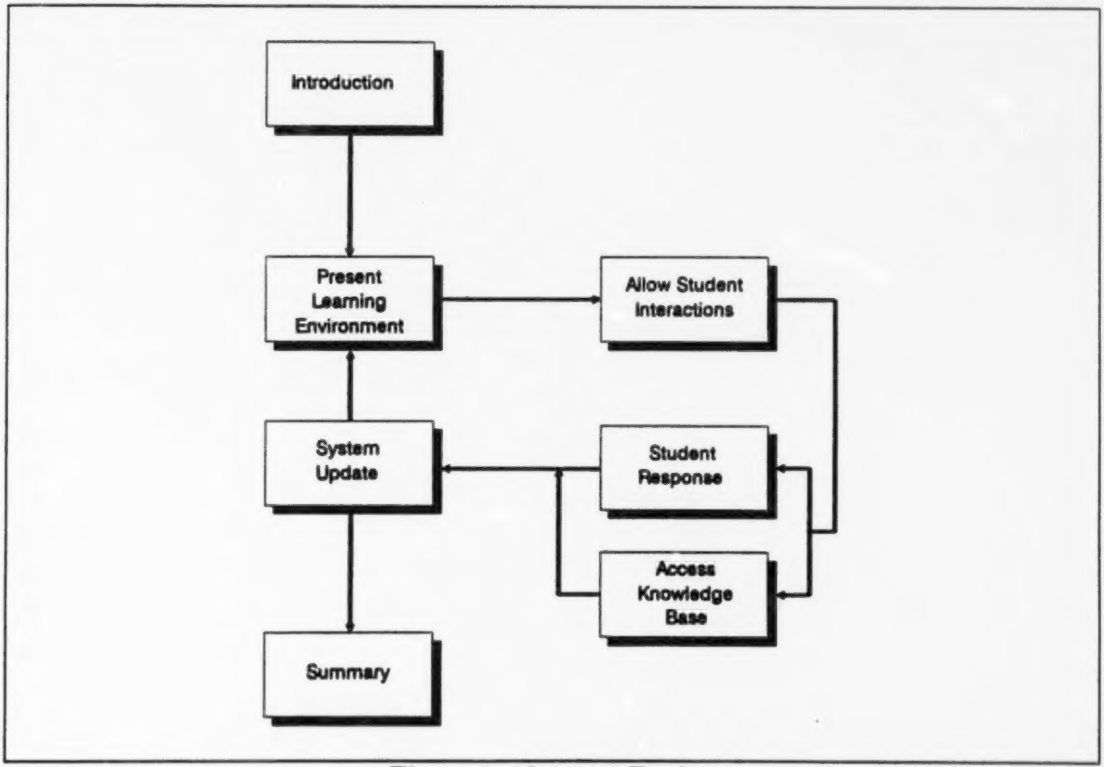

Introduction
Present Learning Environment
Allow Student Interactions
System Update
Student Response
Access Knowledge Base
Summary

Figure 4: Alternate Design

Thus the emphasis is moving from an instructor-led approach to one of student emphasis and control (the paradigm shift). While this in no way suggests that instructors are not required in computer-based education, it does point to the fact that when technology is used for instructional purposes, it may be most effective when used by the students as a tool rather than by instructors as a surrogate teacher.

The following brief example compares the student-centred and instructor-led approach to highlight the paradigm shift towards student-centred learning, and uses a familiar logic puzzle (based on Mandell, 1986) to illustrates the difference between being told and discovering.

The Student Centred Approach

> *Please read this extract:*
>
> *On the last visit to Mars, the chief scientist gathered three specimens of Martian plant life to bring back to Earth: a garble, a farfel and a tsientsien. However, the vehicle for local travel was not big enough to hold more than the scientist and one specimen. Moreover, the scientist knew that garbels eat farfels, farfels eat tsientsien, garbels don't eat tsientsien and the tsientsien don't eat. Assuming all other astronauts were unable to help, how could the scientist transport the garble, farfel and tsientsien one at a time so they would all be safe?*
>
> *Develop a solution to the problem.*

The Instructor Led Approach

> *In today's lecture, I wish to discuss one of the problems which confronted the last expedition to Mars.*
>
> *On that occasion, it was decided to gather three specimens of Martian plant life to bring back to Earth: a garble, a farfel and a tsientsien. However, the vehicle for local travel was not big enough to hold more than the astronaut and one specimen. It was also known that garbels ate farfels, farfels ate tsientsien, garbels didn't eat tsientsien and the tsientsien didn't eat!*
>
> *On a number of occasions, only one astronaut was available to transport the Martian life, who therefore had to devise a means of transporting the creatures to the ship one by one. The method devised was as follows:*
>
> 1. *The farfel was taken to the ship, leaving the tsientsien and garbel.*
> 2. *The astronaut returned alone*
> 3. *The tsientsien was taken to the ship and left.*
> 4. *The astronaut returned with the farfel*
> 5. *The astronaut left the farfel and took the garble to the ship.*
> 6. *The astronaut returned alone*
> 7. *The astronaut took the farfel to the ship.*

Comments

While it can be argued that there are circumstances for using problem solving exercises and other situations where the tutorial (instructor-led) approach would be more appropriate, this example illustrates how the same content material may be presented in different ways. More importantly, it demonstrates that content may not require specific prior knowledge for interpretation and manipulation. Teachers and trainers should remember they are often dealing with mature, capable adults. While many may argue that student's require specific guidance, there is increasing evidence and thought that learning will be more effective when knowledge is gained through individual pursuit and endeavour (Schank & Farrell, 1988).

Learner Integration

This observation also reflects the paradigm shift addressed throughout this discussion, which suggest a movement towards focusing on the learner rather than the instructor/content, which will necessitate a change in courseware structure and appearance. In many ways, this "new" courseware will be similar to some of the original exemplary models of CAL which were geared towards individual analysis and problem solving. It would appear that this approach has been neglected because it requires additional effort and extensive programming skills.

However, it is anticipated that this courseware format will become the standard, and will focus on different instructional parameters, as illustrated in Figure 5. In this case there is an emphasis on what activities the learner will be required to complete in terms of performance. This will be supported by placing the learner into the subject or work environment where they will be required to act upon activities (both planned and random) which occur naturally in that environment. This **Learner Integrated Training Environment (LITE)** is designed to provide a true fidelity simulated environment where the focus of the interactions is the student and the outcomes of their actions.

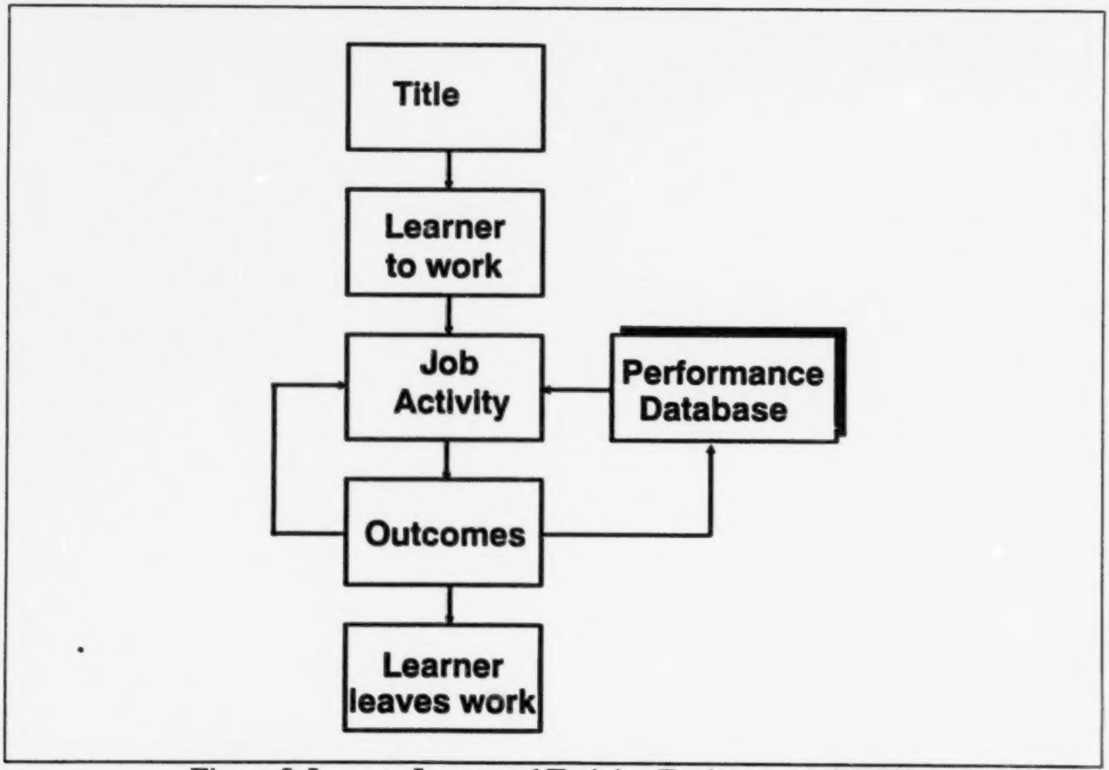


Figure 5: Learner Integrated Training Environment (LITE)

While this is a development and modification of the simulation format of CAL, it is also an attempt to address the fact that CAL has not been successful. The LITE environment is suggested as a way to re-think the way CAL (and other instructional resources) are designed and implemented.

Technophobia

Despite the options and potential for technology as an effective instructional resource, there is also the danger for technology to direct its integration into education and training. This section examines the concept of *technophobia*, which is considered to refer to the ways in which technology is promoted as an answer to educational problems.

In 1976, Dr Donald Bitzer made a presentation to the Australian Computer Society conference in Perth. During this session, the PLATO computer-based educational system was unveiled and it demonstrated a new era in educational technology. Dr Bitzer was able to show a touch screen, random access slides, animation, answer judging and communication through a link to a mainframe in the USA. At the time, the potential for PLATO (and educational technology in general) to revolutionise education was publicised. It was also about this time that computers for school education were introduced.

More recently, Fenty (1990) made a presentation at the ADCIS Conference in San Diego, which again portrayed the capabilities and potential for computer-based education. In this instance, the technology was a remote-controlled undersea robot which was able to be manipulated by school children to investigate new environments.

In both these cases, even though 15 years apart, the technology was perceived as being an inherent solution, something which would solve the educational problems constantly identified by instructional practitioners and the media. However, it appears that there was little consideration as to the real educational issues, with the assumption that because technology could do it, it was therefore instructionally sound. Unfortunately, time has shown that technology itself will not solve the various educational and training problems.

Another aspect of technophobia is the impression that today's technology is not quite perfect, and tomorrow's will always be better. For example, when the PLATO system was first released, delivery was on a monochrome graphics mainframe terminal, which was superseded by a graphics personal computer which evolved into a colour display. However, for each of these steps, many practitioners opted to wait for the next release or model, believing that tomorrow's technology would provide the answers. The significant factor for education is that technology should be viewed in the present, to address current needs. Waiting for newer, faster and more colourful products will not help the instructional process.

In fact, since the PC market has burgeoned, computer-education is portrayed as down market if it does not include some or all of hypermedia, multimedia, CD-ROM, Interactive Video and DVI. Worse still, many specialists in educational technology would now appear to be unfamiliar with many of the technological options, leading to a diversification rather than integration of educational technology skills.

In addition, vendors are now demonstrating the simplicity of current technology with extravagant visions of the future. While impressive, it remains educational fiction. It is the contention of the writer that it is time for the technological craze to stop, for educators to sit back and consider the actual educational requirements and how best they can be solved with available, affordable and accessible technology.

Futures

So what is the future for educational technology?

First, users must become the major focus of any instructional choice. This is not to deny research playing a major role in the assessment and evaluation of new technologies, but to emphasise the most important factor in the instructional process: the learner.

Second, selected factors must be considered which relate to the instructional attributes of the process, rather than the technological features. For example, economics of education is now a major issue and technology can help reduce teaching time through both CAL and CML applications. However, the tradeoff is that a great deal of effort must be placed on the development of such applications to ensure that the content is effectively delivered.

Third, technology must not be the determinant of instruction. While there is no doubt that technology has significant benefits, in itself, technology is not the answer to educational solutions. What is important is direction:

> Computers can be a vehicle for introducing creating thinking ... but first we must break out of our current model of what education is all about; the computer revolution can be an educational revolution, but only if we make it one (Schank & Farrell; 1988:193).

It is time to rethink the way we teach, the way we train and the way instructional resources are designed and applied to education and training.

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RESPONSE

Technology and Tertiary Education: Paradigm Shift or Technophobia?

by
Rod Sims

Response by

Michael Crock
CAL Unit
The University of Queensland

In this keynote address, Rod Sims provides us with a clear discussion of how the 'instructional paradigm has altered as a result of technological innovation'. While the introductory sections of the paper lay the foundations for this discussion, I believe it most appropriate to concentrate my comments on the latter critical issues of learner integration, technophobia, and the future.

Rod Sims introduces the concept of the Learner Integrated Training Environment (LITE), and states his anticipation that the model presented will become the standard for future interactive courseware. I believe this concept needs to be further developed in the course of time, and more importantly, in the course of genuine application. The development of revised approaches to CAL with both an appropriate framework and documented demonstrable practical applications are noticeably missing.

With respect to technophobia, it is stated that '...technology was (and is) perceived as being an inherent solution, something that would solve the educational problems constantly identified by instructional practitioners and the media.' I also believe that the same individuals thought that it would immediately solve such problems.

As a consequence of these expectations, I believe that when the results were not immediate, tehcnology itself was often blamed, and the non-productive cycling of surface trial projects with alternative technological applications continued, or were ceased altogether.

This points to the need to carefully consider the range of technologies currently available, and not necessarily selecting the leading edge technology, but the practical edge of technology so that the results exploit the tool instead of the technology exploiting the developer.

With respect to the future, I believe the notions put forward are presented in a short, sharp and concise fashion: (1) the user must be the focus of any instructional choice, and (2) the needs of trainers and trainees should drive technology, not the reverse. The only point I would add to the conclusion is that properly trained and motivated individuals will be the catalyst for the successful wide scale introduction of new information technologies. New technologies should not determine the role and function of future information technologies.

TERTIARY DAY
KEYNOTE ADDRESS
TWO

Tony Whittingham

Chief
Computing and Information Industries
Training Division
TAFE NSW

Tony is the Chief of TAFEs (NSW) Computing and Information Services Industry Training Division.

He has 20 years experience in industry and 16 years experience in adult technical education and is a consultant to Government and industry on instructional systems design. During the past 10 years Tony has focused on the application of information technologies to computer education and training. The results of his research and development in this area have been presented at national and international education conferences.

Tony assisted in the development of TAFEs Computer Training Unit and School of Computer and Information Systems and managed the implementation of a large scale centralised computer managed learning system. He has designed, developed and conducted a wide range of computer systems and applications training programmes.

Tony has a degree in technical education and has completed post graduate work in Photogrammetry at the University of New South WAles. he is active in many professional organisations.

RESTRUCTURING VOCATIONAL TRAINING AND EDUCATION FOR INFORMATION TECHNOLOGIES

Tony Whittingham
Chief, Computing and Information Services
Industry Training Division
TAFE New South Wales

Abstract

Traditional training cannot meet contemporary needs.

The rapid growth and changes that are occurring within the workplace and in the technologies used by commerce and industry are forcing tertiary institutions to re-think their approaches to training and education.

Information technologies provide enormous potential for improving the effectiveness of training and education and delivering a more responsive approach to needs based training. However the transfer of information technologies to the learning environment of tertiary institutions requires structural changes at both macro and micro levels.

This paper provides a broad outline of the re-structuring of a tertiary institution (TAFE New South Wales) to meet the demands for proactive needs based training and education and the structuring of a Division within the institution with the responsibility for providing training and education in information technologies.

The paper also describes a model adopted by the Division for the development of information technology curricula by external consultants.

Introduction

TAFE New South Wales is by far the largest and most complex post-school educational institution in Australia. It operates 107 separate teaching Colleges, and in 1989 enrolled about 420000 students in almost 3500 different courses. TAFE New South Wales employs approximately 6400 full-time teachers and more than 10000 part-time teachers, plus 3800 administrative staff.

The Need For A New Approach To Vocational Training In Information Technologies.

The handing down in August 1988 of the Structural Efficiency Principle in the National Wage Case, by the Australian Industrial Relations Commission heralded the need for a new approach to the development of training by tertiary institutions. Development of appropriate training strategies now requires an understanding of the implications of award restructuring and its applications. These strategies need to reflect technology changes and adopt information technologies to provide experiential training that will enhance skills, provide career path opportunities and greater flexibility in productivity and the way work is performed.

The demand from commerce and industry for skill based training requires that tertiary institutions work closely with clients to determine training needs. Institutions need to be structured so that they can:

- Initiate fast-track curriculum development and revision in response to award and technology changes.

- Establish a national and State monitoring capability that will enable the institution to be proactive in meeting training and education needs.

- identify developments in skills formation policies and priorities.

Restructuring For Vocational Training and Education.

TAFE New South Wales is restructuring in response to the need for revised approaches to the provision of vocational training and education.

The new organisation's Central Executive's top management structure includes a Group General Manager, Education Planning and Quality Assurance with responsibility for all education support policy activities. Within this division a Manager, Vocational and Technical Education assumes overall responsibility for the operation of ten Industry Training Divisions (ITDs) in the following areas:

- Arts and Media
- Building and Construction
- Community and Personal Services
- Business Services
- Rural and Mining
- Tourism and Hospitality
- Transport
- Computing and Information Services
- Manufacturing
- Engineering Services

The Role Of An Industry Training Division.

The primary tasks of the Industry Training Divisions is to plan, co-ordinate and contract the production of curricula:

i) In line with forecast national and state skill needs; and

ii) In response to local industry requirements identified by college personnel; and to develop strategic development programs for TAFE in their specific areas.

The ITDs are based on standard industrial classifications widely accepted by employers and trade unions. The use of established industrial classifications has many benefits for re-structuring tertiary institutions. These benefits include the following:

- Course development can be based essentially on industrial configurations rather than occupational demarcations.

- Improved facility to implement Government policy, which is generally framed in industry-specific terms;

- Training conforms with data on skills, primarily classified by industry;

- Course changes can occur within the context of changes in work practices in different industries;

- Better support for individuals in focussing on the opportunities provided by industries; and

- Easier measurement of outcomes and performance in industry-specific terms.

The Relationship Between Industry Training Divisions And Colleges.

TAFE's 107 Colleges are the primary educational and training units. The ITD/College relationship is that Colleges have operational responsibility for the delivery of training and quality control, while the Divisions will provide a development and quality assurance function. Divisions will be accountable in terms of agreed performance indicators, such as student competencies and client satisfaction.

The Colleges are clients of the Divisions and will be provided with a range of services that include the following:

- Provision of specifications for teacher qualifications and selection criteria.
- Facilitation of the quality control process by setting quality control specifications for a range of matters including course content, teacher qualifications and experience, accommodation and resources etc..
- Monitor staff development needs and provide training if requested.
- Support income generating activities by developing and modifying curricula or course formats for commercial customers.

The new structure allows for the devolution of the curriculum development to consultants with a resultant acceleration in the production and approval processes. Industry Training Divisions will be responsible for planning and coordinating management of projects with appropriate College staff, supervising production and assuring adequate quality control. they will also have an important role in assessing the resource implications of curricula as an input to orderly planning.

The Computing And Information Services Industry Training Division (CITD).

Each Industry Training Division (ITD) is a small, central unit headed by a Chief of Division with a group of highly qualified professionals responsible for the operations of Industry Sector Units. An Industry Sector Unit addresses the training needs of a group of related industries.

The role of the CITD's Industry Sector Units is to liaise closely with the information technologies industries and monitor developments and trends that result in a need for the development or revision of training.

Five Industry Sector Units have been established to provide training and education for the information technologies industries. The following is a brief description of the occupational classifications and work areas within each Industry Sector.

Computer Applications Industry Sector:
Programmer, Systems Analysts, Systems Programmer, Data Processing Manager. Work areas in these classifications include: Programming, Applications Design, Acceptance Testing, Systems Analysis, Project Management and Leadership.

Computer User Services Industry Sector:
Microcomputer Support Specialist, Software Support Specialist, Micro Systems Trainer. Work areas in these classifications include: Technical Support, Project Management, Software Support, Operations Support, LAN Architecture Management.

Computer Communications Industry Sector:
Telecommunications Specialist, Technical Support Specialist, Computer Networking Technician. Work areas in these classifications include: Computer

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Networking Operations, Telecommunications Operations Support, Network Architecture Management, Technical Support.

Computer Based Training Industry Sector:
Trainer, Courseware Author, Instructional Designer, Computer Graphics Designer. Work areas in these classifications include: Technology Based Training, Multi Media Applications, Training Support, User Documentation Development, Computer Assisted Instruction Development.

Information Services Industry Sector:
Database Manager, Records Manager, Library Technician, EDI Specialist, Information Systems Manager. Work areas in these classifications include: Information Systems Operations, Data Management, Library Operations and Management, Information Systems Management.

The Sectors above were defined on the basis of extensive market research related to :

- Areas of work in the information technologies industries;
- Occupational classifications;
- Assessment of future training needs.

A Basis For Vocational Training and Education Development.

Modular Training Development

There is general industry agreement on the requirement for modular course delivery. Modules involve independent units of learning that can be either delivered singularly or in combinations to form a comprehensive package. Modular courses will promote flexibility. The modular system can provide multiple entry and exit points, and will serve to overcome the present deficiencies, whereby people who withdraw from partially completed courses do not gain training credit.

The workplace is changing and training requirements will change as new work organisation methods unfold through award re-structuring. The modular system can accommodate this by easily amending, updating and reviewing subjects rather than reviewing whole courses.

Industry, through award restructuring and new technology, will require tertiary institutions to be able to meet effectively industry's changing training needs.

Competency-Based Training Development

Competency-based assessment and training has been central to negotiations in establishing broadbanding, new classifications, career paths and skill levels.

The Federal Government's funding of programs has been foreshadowed to encourage training to move towards modular and competency-based training provisions.

Specified competencies and outcomes for each level of training will assure quality outcomes for the training provided and guard against any dilution of quality and standards, particularly in proposed broad-based training.

Self-paced learning raises major issues for tertiary institutions. More resources will be required, including equipment, new and different accommodation and administration and record-keeping services. There will be an increased use of information technologies to achieve experiential learning.

Community Training Needs

Community training needs will bring new clients to tertiary institutions who will be lacking confidence in their ability to study. They will probably be older and have had little or no contact with formal education and training. Yet they will present with numerous workplace skills and experiences when seeking progression up the career ladder.

They will require encouragement to study, but many will not fit the student "norm". They will also require their previous skills and training to be accredited.

Specific resources will be required for appropriate curriculum development for community clients. Support will be required for the new courses in teacher training and support staff.

"Special Class" Training Development

There is an anticipated greater demand for "special class" level (high technology) training. Demand for these courses is expected to lead to a need for specialist teachers; and more teachers to handle the demand.

It would seem inconsistent and inadequate if tertiary institutions were to be locked into rigid demarcations while the people they train are flexible and multi-skilled. Tertiary institutions in response will need to be more flexible in:

- Organisation;
- Curriculum development;
- Patterns of attendance;
- Modes of delivery; and
- Provision of resources.

A Model For Information Technology Curriculum Development.

The primary role of an Industry Training Division is to plan and co-ordinate the development of curriculum. Curricula are produced by consultants who may be either internal or external to the institution (TAFE New South Wales). To facilitate this process the Computing and Information Services Industry Training Division has developed comprehensive guidelines for curriculum consultants. The guidelines constitute a development model that results in a 'Course Package' that contains a Teacher Guide, Subject Learning Guide and series of Competency Learning Guides.

The following diagram illustrates the stages in the curriculum development model.

In stage 1 the CITD completes a feasibility analysis to confirm the need for training, identify training requirements, define training competencies and obtain information to assist consultants in tendering for curriculum development.

In stage 2 prospective consultants prepare a project plan to accompany their quotations.

In Stage 3 a contract is finalised between the successful consultant and the CITD. The contract specifies each parties responsibilities and identifies review points for the formative evaluation process.

Stage 4 results in a 'package' for each subject in a course. Features of the package are that it is competency based with the competencies having been defined in consultation with industry.

Computing and Information Services Industry Training Division

Curriculum Development Model

Stage 1

Industry Training Division together with Industry ⇨ ⇨

DATA COLLECTION
- History and scope of training need
- Industry and environment information
- Management attitude
- Skills audit
- Target audience
- Training to job relationship
- Need and demand analysis

DETERMINE COURSE AND SUBJECT GOALS. IDENTIFY AND ASSESS EXISTING COURSES

Training Specification

- **Training Need**
- **Course Purpose**
- **Desired Outcome**
- **Deliverables**

(based on standard model, schedule & style guide.)

- **CML constraints**
- **Review Points**

(to ensure formative evaluation and avoid duplication)

Stage 2

Consultant together with Industry ⇨ ⇨

FRONT END ANALYSIS

- Learner analysis
- Preliminary design

Project Plan

- **Competencies**
- **Methodology**
- **Learner analysis**
- **Delivery process**
- **Resources and their availability**
- **Student costs**

Stage 3

Industry Training Division ⇨ ⇨

Contract

- **Responsibilities**
- **Schedule**
- **Review points**

Curriculum Development Model

Stage 4

Consultant
together with Industry ⇨ ⇨

COURSE DESIGN

- Task analysis
- Develop performance objectives
- Develop measurement items
- Determine appropriate content to achieve objectives.
- Select teaching methods and media.
- Identify existing resources.
- Develop content necessary to supplement existing resources.

Teacher Guide

- Suggested use of resources
- Assessment procedures
- Optional resources
- 'Tips'

Subject Learning Guide

- Subject Outline
- Pre-requisites
- Competencies Flow Chart
- Resources
- Assessment criteria
- Specific requirements

Competency Learning Guides

- Competency Statement
- List of Objectives
  - Objective 'A'
    - Introduction
    - Pre-test items
    - Content (emphasis on use of existing resources)
    - Activities
    - Post-test items
    - Diagnostic answers
  - Objective 'B'
- TAFE Competency Assessment

The aims of CITD's curriculum development process are to produce curricula that :

- Provide flexibility in course delivery;
- Ensure quality assurance and create a structure that enables quality control;
- Allow for performance based mastery learning;
- Facilitate the establishment of a learning environment in which;

  ... Learners have greater responsibility for their own outcomes;
  ... There is increased personal contact between teacher and learner;
  ... The teacher is able to focus on exceptions and not routine presentations.

Conclusion

The rapid growth and changes that are occurring within the workplace and in the technologies used by commerce and industry are forcing tertiary institutions to re-think their approaches to training and education.

The traditional 'fixes' that are acceptable to the establishment and easy to implement will not yield significant improvements.

Major structural changes are required that will enable tertiary institutions to respond to the demands for training and education created by developments that include award restructuring and technology changes.

Structural changes need to be accompanied by new methods for curriculum development that take advantage of information technologies that in turn can provide;

- Competency based learning and assessment;
- Quality assurance and control;
- Experiential training;
- More learner centered environments.

RESPONSE

Restructuring Vocational Training and Education for Information Technologies

by

Tony Whittingham

Response by

Helen Parker
Queensland Distance Education College

Tony Whittingham's paper properly draws the reader's attention to the major changes occurring in Australia's workplace. Changes are being experienced in the rapid advances in technology used in the workplace - but, perhaps even more importantly for educators and trainers - changing industrial relations and work practices are creating a vocational climate never before experienced in this country.

Tony's paper then challenges TAFE's role in this emerging workplace. TAFE's traditional approaches in terms of infrastructure, curriculum development, and program delivery are viewed as too cumbersome. A new approach is required of TAFE.

Using his current experience in Computing and Information Services (TAFE NSW) Tony argues that TAFE may best service industry through:

- Streamlining TAFE's bureaucracy - especially with regard to curriculum development and program delivery
- Working together with industry on most TAFE enterprises
- Emphasizing a modular approach to training
- Employing a competency based training approach to as many programs as possible
- Employing highly specialist teachers to be as technologically relevant as possible.

Reacting as a fellow TAFE professional to Tony Whittingham's paper, my basic concern is as follows: do the actions derived from Tony's astute reading of workplace needs go far enough?

It seems that TAFE managers still view the primary training opportunity as being sounded by *x* number of TAFE Colleges; our own TAFE curriculum development procedures; and learning resources.

Through our own TAFE experience and through Reports such as the recent **Deveson Report**, we know that industry has equal (if not superior) training infrastructure resources; training resource packages; and technology specialists. Our TAFE view of what constitutes the training marketplace has to be wider than the *x* TAFE Colleges and the accompanying bureaucracy (regardless how streamlined such a bureaucracy is!)

From many viewpoints - economic, philosophical, social - it appears necessary for there to be a 'pooling' of training resources. The challenge for all those in the training marketplace - especially TAFE - is how to develop mindsets and accompanying techniques which allow the community pool of training resources to be accessed and exploited.

TERTIARY DAY

KEYNOTE ADDRESS

THREE

Craig Sherrin
Manager
Vocational Education and Training Technologies Centre
VEATT Centre

Manager, Vocational Education and Training Technologies Centre, a commercial unit of the Queensland Bureau of Employment, Vocational and Further Education and Training. The Centre, Australia's first, has been established to improve the knowledge and skills of the workforce through the application of appropriate technologies to the design, delivery and management of learning. Formerly the Assistant Director - Technology Services within the Queensland Department of Education, he has extensive experience in educational policy formulation and the introduction of a range of innovations, particularly those relating to the new technologies and their impact on education and educational administration.

TERTIARY TRAINING IN THE INFORMATION TECHNOLOGY AGE

Craig Sherrin
Manager
Vocational Education and Training Centre

Abstract

Traditional learning structures and practices are inappropriate to the needs of learners and organisations operating in a national environment characterised by rapid change. Australia's changing role in the global market place and the progressive transformation of our enterprises, their operating practices, workplace structures and communications technology challenge the way we approach the delivery of training in the workplace.

This paper will examine the demand for training within Australian industry, and the potential of new learning technologies to further improve the productivity and cost-effectiveness of training, and so enhance personnel and organisational performance.

For many years Australia experienced strong economic growth based on our large reserves of natural resources. The severe economic recession of the early 1980's in Australia, North America and Western Europe exposed Australia's deteriorating international trading position. A sharp increase in the value of imports, coupled with a dramatic fall in world prices for many of our traditional exports in the mining and rural sectors have produced a rapid growth in our international indebtedness. The current account imbalance - $20.7 billion or 5.6 per cent of Gross Domestic Product in 1989/90,[1] has stimulated a national debate and increased awareness of the deficiencies of our uncompetitive structures and practices within our private and public sectors.

This debate has been focussed by a number of national reports which included *Skills for Australia*,[2] *Industry Training in Australia: The Need for Change*,[3] *A Changing Workforce*, [4] *Training Costs of Award Restructuring*,[5] all commissioned by the Commonwealth Government, *The Global Challenge*[6] prepared for the Australian Manufacturing Council; and the Australian Council of Trade Unions and the Trade Development Council's *Australia Reconstructed*.[7]

In general, these reports concluded that Australia could not expect to improve our competitive position without broadening our trading base by the expansion of processing resource based products and the development of a sector that produced elaborately transformed manufactures. Increased competitiveness in these sectors was seen to be dependent on non-price factors such as productivity, quality, innovation, skills and technology. Underpinning these conclusions was a broad based awareness of the vital role that education, training and skills formation will play in the future economic development of our nation. The ongoing debate highlighted significant deficiencies in the economic skills base.

The latter half of the last decade witnessed strong employment growth in the service industries, with minor job growth in the manufacturing sector. These net changes led many commentators to argue that the introduction of new technologies into the workplace would polarise the skills needs of industry - a small core of highly skilled technologists and a large pool of low skill workers.

This perception has largely been dismissed following overseas experience; particularly in Japan, other fast growing economies in the Asian Pacific region and Western Europe. Their experiences indicated that the introduction of new workplace technologies resulted in the deskilling of some jobs with the creation of other new jobs involving a complex set of new skills. It was found that the skill base associated with new technologies was more dependent on the incumbent management process than the nature of the technology.

Skills for Australia argued that:

> *The world's most successful economies have typically given high priority to basic education and to skills which determine competence at work. They have shaped their skills development policies accordingly. Australia has not seen this relationship so clearly, the time has come to do so, and to act accordingly.* (Dawkins, 1987, p5).

The report of the Training Costs Review Committee commented on "an emerging consensus" between governments, unions and industry towards training and skills formation. This approach has promoted training and workforce reskilling as the critical element in national micro-economic reform. The report concluded:

> *Both industry parties and government have a firm expectation that award restructuring and related reforms will help Australia broaden the national skill base and regain a competitive advantage in international trade and its former standing among advanced nations* (Training Costs Review Committee, 1990, p8).

This paper will examine the training demands arising out of the economic imperative and the progressive transformation of our workplace structures and their operating practices. In particular, the potential of new learning technologies to meet these demands to improve the productivity and cost-effectiveness of training will also be discussed.

THE TRAINING DEMAND

Skills development within the Australian workforce is needed to respond to rapid technological change and reforms in award restructuring. The flexibility and speed with which our public and private training providers are able to adapt to these changed circumstances, will determine the pace of the broader structural adjustments required for Australian industry to become internationally competitive.

The demand for increased training and skills development has acquired an urgency because of persistent skills shortages in some industries. The *Global Challenge* reported that surveys of managers in the metal industries during 1990 have indicated that shortages of skilled labour are managers' most pressing concern.

Demographic changes within the Australian workforce are also placing increasing demands on industry training practices. The "greying" of Australia and steadily increasing high school retention rates are diminishing the numbers of young people seeking entry and post entry training. Consequently, industry will be required to place a greater emphasis on adult retraining and a recognition that skills acquisition is a lifelong process.

The report *Industry Training in Australia - The Need for Change* also highlights the increasing participation rates of women in the workforce as men withdraw earlier from the workforce. In a few years, women will constitute almost half of the workforce between the ages of 20 and 44. These women, many of them mature age returning to the workforce, will place increasing demands on training providers.

As mentioned above, technological change also imposes demands on training and reskilling. Overseas experience, particularly within Western Europe, has shown that new technology is utilised at its maximum productivity when commensurate investment is made in training and workplace management practices.

Underlying these increasing demands on our training resources is the nationwide problem of adult literacy. In some industries, this problem surmounts deficiencies in trade skills as the most serious factor limiting industry productivity. The *Global Challenge* quotes a number of disturbing indicators that give a dimension to the extent of the problem.

> *ABS Labour Force statistics indicate that 55% of employed persons in manufacturing industry were born overseas, compared to 30% for all other industry sectors. The AMWU estimates that 20% of metal industry workers are functionally illiterate, while a report for the Food Industry Training Council has estimated that 50 to 80% of workers in the Food Industry have a literacy problem. The total cost to the nation of adult illiteracy is estimated to run at over $3 billion per year. At the level of individual firms, the introduction of new technology, multi-skilling and team-based work approaches will founder where employees cannot communicate effectively. (Pappas et al, 1990, p65)*

The August 1988 National Wages Case decision by the Federal Industrial Relations Commission introduced a new wages system for Australian workers based on the Structural Efficiency Principle. This system established a linkage between salary increases and the acquisition of predetermined levels of skills. The acquisition of these additional higher level skills and the increased range of skills covered by the system will place further heavy demands on training providers within the public and private sectors.

The Training Costs Review Committee has endeavoured to quantify the increased demand for training arising out of these factors. The Committee estimates:

> *..that by 1995, industry expenditure on training in Australia will increase from $1.3 billion to $1.9 billion in 1989 constant dollars, an increase in training expenditure of about 50 per cent over the next five years. (Training Costs Review Committee, 1990, p24)*

The quality of training is just as important as the quantity. Increases in participation rates will need to be complemented by improvements in the quality and flexibility of our education and training services. The inquiries cited in this paper have documented the matters of concern about the nature and quality of Australia's education and training arrangements:

- the need for a high quality basic education as a foundation for vocational training. This basic education should include skills associated with life-time learning, communication skills, personal initiative and the achievement of excellence.
- secondary and tertiary education should focus on the acquisition of broad based transferable skills which will enable workers to adapt to change in the workplace.
- industry must provide ongoing training programs to facilitate the adaptation of these broad based skills into specific skills required in the workplace.
- the skills boundaries between trades are critical and poorly specified. Consequently, skills development associated with particular trades is unduly narrow and often fails to meet industries' needs.
- formal skills training appears to be more highly geared to time restrictions rather than specifying basic competencies required.
- adult training in Australia is primarily focused on the "front-end" which tends to emphasise the myth that training is a one-off affair and neglects the pressing need for retraining and on the job upgrading of skills.

The *Global Challenge* quoted researchers in MIT's 1989 study into overseas competitiveness as a description of the cultural and attitudinal problem confronting Australian industry.

> *We have concluded that without major changes in the ways schools and firms train workers over the course of a lifetime, no amount of macro-economic fine-tuning or technological innovation will be able to produce significantly improved economic performance and a rising standard of living...*
>
> *... the issue is not mainly what workers will do when motivated but rather what they can do, given their weaker basic education and the kind of work experiences provided by companies that have low regard for training and few institutional resources to provide it. There seems to be a systematic under devaluation in this country of how much difference it can make when people are well educated and when their skills are continuously developed and challenged. This underestimation of human resources becomes a self-fulfilling prophecy, for it translates into a pattern of training for work that turns out badly educated workers with skills that are narrow and hence vulnerable to rapid obsolescence.* (Australian Manufacturing Council, 1990, p74)

The role of education and training systems in fostering and developing Australia's industrial competitiveness is critical. A number of structural changes are currently underway - award restructuring, the training guarantee and the adoption of national training standards. However the challenge surpasses mere structural change and requires a fundamental change to our management philosophies and the way we value our people - not just as another factor to cost into the production equation, but as industry's most valuable resource that, if developed by appropriate investments in training and education, will meet the quality and productivity challenges confronting Australian industry.

THE TRADITIONAL LEARNING SETTING

Structured training arrangements in Australia are characterised by narrow based offerings with limited skills coverage restricted by narrow trade definitions. These arrangements are generally focussed on the front end delivery of initial vocational training with limited resources provided for on the job upgrading of skills.

Of greater concern is the setting and structure of the traditional learning models by which most training and skills development are delivered. Traditional learning refers to the grouping of learners together to receive information from an "expert". The traditional learning model is inappropriate for the delivery of learning in an environment characterised by rapid change and an organisational culture that relies on "adaptable, flexible innovative and multi-skilled people".

The traditional learning model is predicated on a number of assumptions:

- traditional learning assumes that all participants commence the learning process with the same knowledge and skills. With the emphasis on re-skilling and adult re-training, participants will enter the learning process with a wide range of knowledge and skills.

- traditional learning assumes that all learners progress at the same pace. Most traditional learning models involve learners progressing through the same amount of content in the set time. This assumption usually means that only a proportion of the group are able to match their learning rate to the instructor's; the others are either left behind or become bored at the slow rate of learning.

- traditional learning assumes that there exist large groups of people who all require to end up with the same sets of knowledge and skills at the end of the learning process. The increased need for specialisation and for retraining are not facilitated by this assumption.

- the traditional training model utilises a process whereby the expert inputs their own paradigm view of reality. This process tends to produce convergent thinkers who agree with the "expert" and one another. Australian industry desperately needs divergent thinkers who are capable of working in a team to solve emerging problems.

- traditional learning is resource intensive. Groups of people are taken from the workplace, resulting in lost productivity and dislocation.

- traditional learning is largely a passive event in which the learner attempts to assimilate knowledge from the expert presenter. This process does not reflect the realities or demands of the workplace and frequently fails to produce any significant improvements in worker performance.

- traditional learning is predominately focussed in the measurement of inputs, such as number of students, teacher/student ratios, number of contact hours and cost per student. Modern industry requires training focussed on outputs - the accurate measurement of learners' competencies.

The rapidly increasing demand for training will place additional burdens on training providers. This burden will fall at a time when there is a large unmet demand within the major training provider - TAFE, and a significant number of organisations without any structured training for their workforce. This problem is likely to grow unless radical action is taken to dramatically enhance the capacity of public and private training providers. Without massive injections of capital to further duplicate existing training facilities across Australia, we need to examine the potential of new learning technologies to improve the productivity, cost-effectiveness and responsiveness of training.

NEW LEARNING TECHNOLOGIES

To help organisations meet the challenges of change, it will be necessary to adopt training models and systems that individualise instruction. These models facilitate the entry of adult learners with a wide range of knowledge and skills and varying rates of learning.

Individualised computer based learning systems have been developed to support self paced learning materials that allow students to learn at their own rate in a place and time that suits them. The use of self paced learning materials allows the development of courses which are learner-driven, rather than instruction-driven.

These computer systems require minimal involvement of training personnel. The instructor is freed to manage the learning process and to assist learners who encounter particular difficulties in a one to one situation. Learners are able to enter the learning process at a range of entry points dependent upon their existing competencies and to move through the learning sequence by a variety of pathways, contingent on their learning rate, individual needs and background knowledge and skills

The administrative capabilities of these computer based learning systems allow for improved monitoring of student progress and achievement. The capacity to interface with a wide range of multi-media formats makes the learning process more interesting and improves learner retention.

Computer based learning systems are frequently grouped together under the umbrella term - Computer Based Training (CBT), to describe the use of computer based technology in educational and training situations. Two of the major subcomponents associated with CBT are Computer Assisted Learning (CAL) and Computer Managed Learning (CML).

CAL is an interactive instructional technique in which a computer is used to present instructional material, monitor learning and select additional instructional material in accordance with individual learner needs.

CML involves the use of the computer to maintain and analyse data on learner performance and instructional progress an an aid to trainers. The major distinction between these two subcomponents is that, with CAL, the learning material is delivered to the student by computer, while with CML, the computer is used to manage the student's progress through the learning material.

The progression for existing private sector training organisations to a learner centred, self paced mode of training will require an evolutionary approach. The majority of existing training materials in Australian industries are print based with some supplementation with other media resources such as video. The greatest demand for training exists in the area of small to medium sized organisations who cannot afford the relatively high development costs associated with some training delivery systems such as CAL.

At this stage the development costs associated with the production of CML materials are relatively low. The level of technology associated with its use make it an ideal entry point for organisations seeking to improve their training productivity through the introduction of individualised computer based learning systems.

CML offers significant advantages to training organisations, instructors and students. These are summarised as follows[8]

- CML maximises existing learning resources - it is not technology hungry. The development costs of CML materials are significantly less than CAL.
- CML greatly reduces the administrative workload of instructors, thus allowing them to interact with individual students who require assistance.
- CML supports the use of self paced learning materials through the use of computer generated tests. Students can undertake a pre-test from the system to determine whether they are competent in a particular unit. The results of this pre-test and other tests throughout the module will determine the student's learning path through the course.
- In this way, CML and self paced learning take account of and give credit for the individual skills and abilities of students regardless of where these skills and abilities have been acquired.
- Post-tests are undertaken at the completion of each learning unit to test competency. As with the pre-test, the results of the post-test will determine each student's learning progress.

CML has the potential to significantly improve the productivity and cost effectiveness of training within Australian organisations. The transition from traditional training models to CML can be easily facilitated for little or no nett increase in financial outlay.

CONCLUSION

Traditional learning practices and structures are incapable of meeting the dramatically increasing demand for training and skills development within Australian private and public sector training organisations. Flexible, learner centred training models and delivery systems are required if Australian industry is to become internationally competitive. These changes must be complemented by ongoing changes in organisational management practices, culture and attitudes if the full benefits of these practices are to be realised.

The use of new computer-based learning technologies promises to deliver learning and instruction that is learner centred and cost effective. CML provides a convenient entry point for organisations to adopt these new leaning models and offers considerable advantages to organisations and learners.

Charp[9] succinctly describes the challenge confronting Australian organisations in the paper *Computer-Based Training and Advanced Training Technologies*:

Education and Training is increasingly being treated as a strategic investment, and utilisation of the best tools in not an option but a necessity.

[1] Training Costs Review Committee, Training Costs of Award Restructuring - Volume 1, AGPS, Canberra, 1990.

[2] Dawkins, J S, and Holding, A C, Skills for Australia, AGPS, Canberra, 1987.

[3] Dawkins, J S. Industry Training in Australia: The Need for Change, AGPS, Canberra, 1988.

[4] Dawkins, J S, A Changing Workforce, AGPS, Canberra, 1988.

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[6] Australian Manufacturing Council, The Global Challenge - Australian Manufacturing in the 1990's: Final Report of the Study by Pappas, Carter Evans & Koop/Telesis, Melbourne, 1990.

[7] Australian Council of Trade Unions and The Trade Development Council, Australia Reconstructed, AGPS, Canberra, 1987.

[8] These advantages are summarised from the Queensland Bureau of Employment, Vocational and Further Education and Training's Instructional Design Course handbook.

[9] Charp, S, *Computer-Based Training and Advanced Technologies*, Computers in Education, Elsevier Science Publishers, 1990.

RESPONSE

Tertiary Training in the Information Technology Age

by
Craig Sherrin

Response by

Steve Murray

Craig Sherrin's paper provides an overview of training issues in Australia during the last 10 years. Craig quotes from many publications of the various committees and organisations in Australia that have addressed the area and points to the need for dramatic changes in the training area. At a general level the paper concentrates mainly on worker retraining issues and as such the inclusion of 'Tertiary Training' in the title may be misleading. However the abstract does indicate that the 'delivery of training in the workplace is the focus.

Craig explores this demand for training in terms of a response to technological change, award restructuring, shortages of skilled labour, increased participation of women in the workforce and need for adult literacy programs. Assumptions inherent in the traditional learning setting such as the need for similar initial learner skills, similar learner progress rates, similar learner exit skills, delivery of the expert's view of reality, personnel intensive implementation and lack of focus on output skills are also discussed. Craig states in a summary way that 'the potential of new technologies to improve the productivity, cost-effectiveness and responsiveness of training' must be explored.

While one could take issue with some of the individual quotations and statements made the thrust of the paper that 'traditional learning practices are incapable of meeting the dramatically increasing demand for training and skills development within Australian private and public sector training organisations.' is an easy one with which to agree.

The argument regarding computer managed learning is well supported in the paper. I got the feeling, however, that while CML offered many advantages the real benefit was that 'little or no nett increase in financial outlay' was required. It may well be that for some reasons of finance, practicality, lack of expertise or limited available resources that CML is the 'only' alternative at present. However if this is the case then it may be appropriate to explore longer term possibilities and alternative solutions.

Reference is made in the paper to other countries with better economies or successful reskilling practices or higher basic education standards. Mention is made of cultural ideologies and attitudes and how these appear to have made positive contributions in countries that have greater use of information technologies in their work and/or training environments. The whole area of cultural and attitudinal factors influencing the Australian student and worker needs to be more adequately addressed future and is one that I regard as crucial to the maintenance of educational standards and the development of skills that are appropriate to the information technology age.

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